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THE

AMERICAN NATURALIST.

VOL. XII. — *JANUARY*, 1878. — No. 1.

SOCIAL LIFE AMONG OUR ABORIGINES.

BY W. H. DALL.

"One touch of nature shows the whole world kin."

THE materials and the man have not yet come together which are to result in any picture of the social life of the American Indians or Eskimo equal in fidelity to that which is printed of our own social life on the pages of the ordinary "society" novel. At least this is one of the reasons why nothing has ever been published which exhibits to the civilized reader the play of sentiment and passion, fear, hope, aspiration and reverence which actuate the red or the brown man as much, if in different mode, as they do his paler cotemporary. It is true we have the novel of the Cooper class, in which a red man, evolved from the inner consciousness of the author, is impregnated with the ideas and sentiments of a Chateaubriand. This has, however, become antiquated, even with the philanthropist, and seldom furnishes texts for missionary meetings in these days. We have numerous graphic accounts of the manners and customs of the Indian tribes as regarded from the white standpoint, but these are wholly defective in the region of greatest interest, that of the native mental atmosphere. There are speeches, still to be found in school readers, in which Indian chiefs apostrophize the "Great Father" in language well chosen and eloquent, dignified by its simplicity and directness, and only unsatisfactory from the absence of any means of knowing how much of the reporter or interpreter is combined with the original.

It is hardly to be expected, perhaps, that the "squaw-man" of the west or the keen-witted trader of the north would realize the

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value to the world of a faithful picture of the life which he (more than any other man) is better situated to observe; even if he were competent to delineate it. Where shall be found a Becker who will give us an Indian "Charicles"?

Another and most serious difficulty lies in the way. In the life of the average native, especially in the far north, there is little but a struggle for existence with a niggardly environment. Their festivals are few and consist chiefly of eating and violent motions, termed dancing for want of a better and more characteristic word, or in donations where the host is the giver. Their shamanistic performances, full of excitement and interest, still have little to satisfy the love of enjoyment latent in every human being. Having no theatres, no books, no *improvisatores*, no means more rational than the above-mentioned examples for exciting pleasurable sensations, there is no reason for wonder when we find in the savage mind the physical relations of sex, representing to him nearly all that civilization finds in art, literature or philanthropy. Ideas connected with these relations as his sole source of unalloyed pleasure, permeate all his social relations, his wit, his motives, his tales, traditions, animistic faith and desires.

Hence, not only would the faithful relation of the mental phases of his life be unsuited to modern taste and modesty, but the mode of action of other sentiments in his mind and social relations, not in themselves offensive, is so intermingled with the first mentioned as to render the representation of them, if dissected separately, in most cases only a mangled caricature of savage thought.

To the same absence of means for rational pleasure may be ascribed the fatal predilection for drunkenness and gambling universal among savages and reappearing among the very poor in the slums of great cities.

Dr. Rink, in his "Tales and Traditions of the Eskimo," has come nearer than any one else toward occupying part of the vacant field by a judicious expunging of the erotic element in the folk-lore he relates.

The personal experience of the author during several years in Northwestern Alaska gave him now and then a glimpse of the social thought of the Eskimo and Indians by whom he was surrounded, and from these reminiscences may be gleaned a few items which, without trespassing on the realm of Cooperian fiction, may give a slight insight into the working of the human mind under savage conditions. But it must be recollected that

any view of native characteristics which leaves out the erotic element, resembles a vine from which the trellis has been removed.

The Eskimo of Norton Sound, Alaska, resemble most of the northern savage peoples in a total absence of reticence on all subjects, except before strangers. After friendship is assured, a matter often a long time postponed after first acquaintance, conversation may be freely indulged in on any subject relating to the individual unless it be the shamanic mysteries or superstitions. In this way I learned that even Eskimo life has its touches of romance. A middle aged woman, employed as a seamstress by our party, told me the story of her life.

Born at Shaktolik, her wanderings had been confined between the Indian territory inland, the Yukon mouth on the south, and the Polar Ocean. When of marriageable age her parents, being old and desiring to settle their daughter in life, took her with them to the Kaviiak country. They had heard of an old man there, very wealthy, according to their ideas, in deerskin dresses and supplies of food, and who, in addition to the two he had already, wished to acquire another wife to be the youthful pet of his old age. They arrived at his house in the depth of winter, were hospitably received, and opened negotiations. The wayward girl, moved by the contemptuous glances of the elder wives, the absence of eye-lashes and presence of sundry wrinkles in her proposed partner, or by the fact that she would be wholly separated from her own people, fled in the night with a passing party of dog-sledges and natives, leaving her chagrined parents to settle as they might with the Kaviiak sage.

At Shaktolik she knew a young Eskimo, tall, handsome, a good hunter, and unmarried. Friendly glances passed between them; in short, she loved him and hoped to be his wife. To adorn his deerskin garments, to applaud him at the winter dances, to proudly receive the sinew and belly of the deer, wife's perquisites, when, on his return from hunting, she met him with the smoking dishes of seal meat and fish she knew so well how to prepare—these privileges she lovingly and proudly anticipated. Alas! "his face was very good but his heart was very bad." After trifling with her affections for months he left her for a more engaging damsel, who, to the vindictive joy of the abandoned one, also suffered in her turn.

For a long time she refused all propositions of marriage; the

very thought was hateful to her. Then came a misfortune. While she was off with a salmon fishing party, preparing the winter store of dried fish, her parents and entire family went southward to another village on their way to set their nets elsewhere.

During the salmon fishery it is against Eskimo ethics to boil water inside the house. It is bad for the fishery. The soup-pot was set near the beach and while the others were collecting bits of driftwood, the youngest child, a few years old, moved thereto by sorcery on the part of the Indians of the interior, threw grass and poisonous plants into the boiling pot. All ate and died. Poor Atleäk was thus left an orphan with no means of support; the inhabitants of the village where they died claiming the property left by her family, and doubtless converting such of it as was not destroyed at the interment to their own use long before the news reached Shaktolik.

She immediately claimed the protection of an only and very distant relative by marriage, in whose house she worked and by her neat sewing and constant industry kept herself supplied (through barter of work for skins) with clothing and other necessaries which were not hers by the communal bond of the tribe. Shortly afterward winter set in and she went northward with a party bound for Kotzebue Sound. It was a hard winter, the deer retreated to the most inaccessible valleys, the supply of fish failed. Her party finding that they could not rely on obtaining food at their various bivouacs, were obliged through semi-starvation to take a short cut to the Sound through the territory of the dreaded and hated Indians.

Traveling as rapidly as possible, one day they came upon a little open spot by the bank of a stream where were two Indian houses. The few footprints in the snow were of women's feet, and curiosity tempted the boldest to peep into one of the houses. The inhabitants were dead or dying of starvation. The men were seeking the deer far away. The women had denied themselves to save little bits for a child some two years old, whose thin cheeks were rosy compared with the wasted ones of his dying relatives. Death was surely coming to them, and after that what but death remained for the boy? They begged the shrinking Eskimo to take him and keep him, that his life might be saved. But the race-hatred was too strong and they had hardly food enough to keep their own party alive. One by one refused.

At last the girl who had lost her lover, who was an orphan (as

she thought) through Indian sorcery, took pity on him and said, "I have no husband to work for, I will take the boy; he shall be my brother, and when I am old I shall not be left alone."

So the Eskimo left the house of death and took the boy. From that time to the time I met her, her hands had been busy for him. He was then a lad of fifteen, bright, active and promising, and knew only the Eskimo life and tongue. His deerskin dresses were as handsome as any in the village and his foster-sister's activity provided for all his needs. Good was returned for (supposed) evil by the poor, ignorant Eskimo girl. She became indifferent to matrimony, since she had an object upon which to expend her love, and it is to be hoped that when age enfeebles her step and bows her athletic form, her adopted child will not forget his obligations. The essential features of this girl's career, at least so far as her love affairs are concerned, are they not duplicated in a dozen novels?

Another phase of life, which one might expect almost anywhere rather than among the Eskimo, I had occasion to observe there.

A young woman, really quite fine-looking, and of remarkably good physique and mental capacity, was observed to hold herself aloof from the young men of the tribe in an unusual manner. Inquiry, first of others, afterward of herself, developed the following reasons for the eccentricity: In effect she said that she was as strong as any of the young men; no one of them had ever been able to conquer her in wrestling or other athletic exercises, though it had more than once been tried, sometimes by surprise and with odds against her. She could shoot and hunt deer as well as any of them, and make and set snares and nets. She had her own gun, bought from the proceeds of her trapping. She did not desire to do the work of a wife, she preferred the work which custom among the Eskimo allots to men*. She despised marriage; held she had the right to bestow favors where, when and to whom she pleased, as fancy prompted, or not at all.

When winter came, having made a convert in a smaller and less athletic damsel, the two set to work with walrus-tusk picks and dug the excavation in which they erected their own house, which was of the usual type of Eskimo houses, walled and roofed

* It must be borne in mind that both sexes work hard, and labor is by custom equitably divided; the more severe work all falling to the men. The women of the family have often more influence in affairs of trade than the males, and there is no discrimination against them.

with driftwood covered with turf. It was, however, as additional defence against unwished-for prowling males, divided into two rooms with a very small and narrow door between them, next which lay some handy billets of wood to crack the sconce of a possible intruder. Here our two Amazons lived, traded and carried on their affairs in defiance of communal bonds and public sentiment.

The latter seemed to be composed half of disapprobation and half of envious admiration; while all the young fellows in the village busied themselves in concocting plans against the enterprising pair. These were too fully on the alert to be surprised, and all efforts against their peace were fruitless. They did not issue a "Weekly," dabble in stock or propose to run for office, but in other respects their conduct formed a tolerably close parallel with some that has been observed nearer home.

When the deer-hunting season came, the ladies were off to the mountains, and no sooner had they departed than disappointed lovers and an "outraged public sentiment" combined in a mob which reduced their winter quarters to a shapeless ruin. So far as my information goes, the following year they returned to the ordinary ways of the world, and gave up the unequal contest against a tyrannical public opinion, so far as their life of isolation was concerned.

I knew of several instances in which attractive young women, "crossed in love," led for at least two years (the period during which I was cognizant of their behavior) a life of celibacy which seemed likely to be indefinitely prolonged. These instances seem opposed to the mechanical theory of life among savage tribes which has of late been strongly advocated. It is true these Eskimo were more intelligent and less depraved than some other races of the same stock and than many tribes of exotic habitat. Still even among the lowest peoples it seems probable that individual energy, taste and opinion are by no means insignificant factors, and may have far greater influence on the common weal than is often taken for granted.

A mother's love for her children is characteristic even of animals, though with the latter it appears to cease with the maturity of the offspring. Among these Eskimo, however, in times of scarcity, if a child be born for whom food can hardly be provided, it is exposed to die of cold with its mouth stuffed with a bunch of grass to prevent it from crying. This is done as a matter of

duty, is considered perfectly justifiable, in fact as the only course consistent with common sense. The child must not cry or its voice will be heard about the house afterward. One of these children picked up and adopted by some one who can care for it, owes lifelong service to the foster parent. It has no property of its own except certain especial articles; it must work for its foster parent and bring to him any wage received for labor. It cannot marry without his consent, and for its life long, in one sense, is a bondsman.

Yet the children reared by their mother are treated with devoted tenderness and care. They are never punished. They receive the last food when others are starving. Their dress glistens with beads and fringes, while the parents can barely cover themselves from the cold. The boy is eager to become proficient in manly exercises. He must keep aloof from the girls until he has killed a deer. All play together until ten or twelve years old; then boys and maidens separate in their sports, except in the village dance house, and even there seldom take part until mature.

The bond of relationship, to fourth cousins, was always respected on the east shore of Norton Sound. It is not universally the case, however, as in the Kaviiak country, I was told, much laxity occurs. Except for this, until married, the communal bond, as in most American races, governs the intercourse of the young people.

Sickness is universally regarded as the result of sorcery exercised by enemies, either of their own race or Indians. This is the belief even when the real occasion of the sickness is clearly evident as it would seem to the civilized mind. When it is the result of particular circumstances, those circumstances were brought about by sorcery. A death in a house necessitates its destruction. Hence the dying, or those supposed to be, are usually taken into the open air unless they own the house and are its governing occupants. Death is often unnecessarily caused by this exposure. The prospect of a death will often make the chief person of a household flinty-hearted toward his housefellow, even if a relative or dear friend. An unusual succession of deaths will alarm a whole settlement and sometimes cause the abandonment of a village-site until not a resident remains.

After a death the women do no sewing for four days, and the men will not cut wood with an axe for the same period. A mother or wife will bewail the deceased for a number of days and

repeat the wailing afterwards at intervals, sometimes for several years. It seems to be in compliance with custom and independent of grief, which is often sincere and deep.

The wooden vessel used for a certain purpose, and of which every Eskimo owns one, is invariably placed over his remains and usually broken. Other property is left about him, differing in amount according to the panic, if any, caused by sickness at the time; to his whole stock of worldly goods or to the grief of the mourners. The personal property of a wife goes back to her relations if they claim it, or is given away to the community. The house-fellows or the community, rather than the relatives, are the inheritors of property; which is more likely in the latter case to go to brothers than to children or wife of the deceased. These house-fellows being the persons who joined forces to build, and who jointly occupy and own the house, form a little society subsidiary to the village commune. These subordinate groups have in domestic affairs considerable importance. The most important, oldest or wealthiest individual takes precedence of the others, and has always assigned to him the corner of the sleeping platform or space at the right hand of and next to the door. He settles disputes, directs the course of domestic affairs of the common household, meets strangers, assigns them their place on the sleeping platform and offers them refreshment by the hand of his wife. There is a certain allegiance due him by all inmates who also have certain duties toward each other.

This imperfect attempt at conveying some idea of the social thought and feeling of a barbarous people, may be followed hereafter by additional matter of a similar nature, but for the present I will close by sketching the daily round of an Eskimo housewife in early winter. Rising in the early hours when first a faint glimmer through the parchment cover of the smoke hole indicates the peep of dawn, her first care is to remove the necessary wooden vessels before alluded to, to the antechamber of the house where their contents are preserved for tanning and other useful purposes. This done she removes the cover of the smoke hole and searches the hearth, where carefully covered embers should still be glowing, and if they are not extinguished, carefully gathers them together, places some light dry sticks upon them and going outside arouses the sleepers by pitching down a quantity of fuel through the aperture in the roof. Before coming in she arranges some bits of wood or boards so as to aid the draught through the

smoke hole, and brings from some adjacent running spring a kettle of water for drinking and cooking purposes. Returning, the beds and mats are rolled up against the wall and the inmates perform their very simple toilets which consist chiefly in putting on their clothing, all of which except a pair of deerskin socks is usually removed at night. A few touches to their hair, a dry wash with a bit of cotton rubbed over the face, or at most with a little fine snow in lieu of water; after which bunches of dry grass are arranged in their boots to fit the foot, the boots are put on and tied, and they are ready for the day's work.

Meanwhile the housewife has prepared the materials for a meal of boiled deer, or seal flesh or of boiled fish with oil. The morning meal, always hurried, is seldom delayed to roast meat or fish on sticks, as at the evening meal. The house-fellows make short work of their breakfast and immediately disperse to visit their traps or pursue the avocations of the day. The remnants of the meal fall to the share of the dogs, the wooden dishes are usually hastily cleaned, and the mistress of the house sits at her daily work. This at this season usually consists in preparing deer skins for boots or clothing, or cutting and sewing the skins into garments. From time to time during the day a morsel of deer fat, a bit of dry salmon or some other fragment of food is incidentally discussed, but without any regularity. Since most of the women are similarly engaged in the morning there are usually few visitors until the middle of the day is passed, unless some girl bringing her work with her, comes in to sew in company with others, if her own house be empty of female associates. Chit-chat, scandal and very small small-talk make up the bulk of the conversation, broken only by directions in regard to work from the more experienced work-woman to the younger ones. As the day draws into afternoon some stranger from another village may present himself, when with few words he is directed to a sitting place, one of the women removes his wet boots and places them, and the straw pads they contain, in the smoke to dry, and something in the way of refreshment is at once offered to him. Silence reigns for a time when slowly, bit by bit, and at long intervals, the stranger tells the story of his journey, the latest news in his own village, and any messages he may bring to the household.

As night comes on, the sewing is laid aside, the smouldering fire is built up to throw out a generous blaze, and one of the

household goes up on the roof to look for the returning hunters or trappers with their spoils. Fur animals are the property of the trapper, but he can only claim exclusive right to the skin, sinew, fat, tongue, head and belly pieces of a deer. The remainder is distributed to any who may need it, or reserved as the common property of the house-fellows, if there are no other applicants. The wife receives her husband in silence, removes his belts and gun case, puts his boots to dry, offers him a bit of meat and fish, and when he has taken his accustomed place, calls his attention to the stranger while she prepares the evening meal. This is the event of the day. The oil lamp is trimmed and lighted; conversation becomes general; all eat together, served by the mistress of the house, and when the repast is over, tales have been told, and the fire burns low, the larger embers are tossed out of the smoke hole, the coals carefully covered, the parchment replaced to keep in the warm air, beds are unrolled, clothing doffed, and the inmates lay themselves head to the fire; the light is put out, and in a short time the silence is only broken by an occasional nasal indication that the hunter is enjoying his well earned rest.

——:o:——

THE SEWELLEL OR SHOW'TL.

BY S. K. LUM.

IN the deep evergreen forests of fir, clothing the western slope of the Cascade Mountains, in Oregon and Washington Territory, is found a singular animal, *Haplodon rufus*, the natural history of which is but little known to scientists.

It is called by various names in the different localities it inhabits; considering it as new, each settler has named it after some better known animal he fancied it resembled. In Southern Oregon, it is found in moist situations on the tops of the Siskiyou and Rogue's River Mountains, and is there called "mountain beaver." On the head-waters of the many streams flowing westward to the Willamette River, it may be seen in great numbers, and is there called "mountain boomer," "ground hog," "gopher," "badger," &c. North of the Columbia River it inhabits nearly all the streams rising in the Cascade Mountains and flowing westward to tide water, also, on the Cowlitz and other tributaries of the Columbia, and in the vicinity of Shoalwater Bay. There it often goes by the Indian name of Shote or Show'tl. Its special habitat is the broken hilly

country forming an elevated bench some two thousand feet above the level of the sea, and lying along the western base of the Cascade Mountains. It is semi-aquatic in its nature, and its haunts will always be found where veins of water beneath the surface of the ground are abundant. It usually selects the open glades of the forest, thickly grown up with fern and sallal (*Gaultheria shalon*). It is emphatically a burrowing animal, and here the ground will be seen perforated with holes. Generally a little hillock of excavated reddish clay marks their entrance, but, sometimes, only a hole large enough to admit the animal passes directly downwards, the earth seemingly having been removed.* Beneath the ground, the various openings connect, and form a perfect "plexus" of passages, often nearly parallel with the surface, and only a foot or so in depth. Horses and cattle frequently

THE SEWELLEL OR SHOW'TL.

fall into these places, to their great annoyance, and the farmer in plowing such lands for the first time, finds much difficulty in getting his team to work. These underground passages, no doubt, extend to great distances, in proof of which, water has been seen falling into a hole in one place, and coming out at another a fourth or half a mile distant.

In many instances I found water coursing its way through these passages which had been worn by the water large enough to take in the body of a cow. Then, again, pools of water appeared beneath the surface of the ground, where the show'tls, young and old, took pleasure in sporting and performing their ablutions. The show'tl's food is the various vegetation of the locality, including shrubs, herbs, roots, etc. These it gathers in a hurried manner above ground, and drags them to the mouth of its burrow. It has been observed to ascend a bush two or three feet, cut off a limb quickly, and retreat with it to its hole. Often, a mass of dried sticks and rubbish may be seen about the entrance to the

* Perhaps such holes are made by the animal burrowing to the surface from below. —ED.

hole, being the refuse of the gathering. I have known it to take possession of a field seeded down to red clover, forming numerous burrows, and seeming delighted to feed upon this herbage. Its strong and sharp teeth seem eminently adapted to cutting off sticks, as in the beaver, although I have observed none more than one-fourth to one-half an inch in diameter, cut off by them. Ferns, sallal and hazel form a large part of its food, which it masticates very fine, as may be seen by inspecting the contents of its stomach.

In general form and color, the show'tl has much the appearance of a huge meadow mole, thirteen to fourteen inches in length from the tip of its nose to the end of its tail, of a reddish color, and weighing three to three and a-half pounds. The males are larger than the females. The tail is short and almost hidden by the long hairs surrounding it. The eyes are small, and apparently but little use is made of them while passing through the burrows. Their whiskers are long and strong, extending laterally beyond their bodies. They have also bristles springing from their fore legs outwardly; these answer in a great measure the use of eyes by touching the walls of their burrows and thus directing their course in the dark.

Its fur is similar to that of the musk-rat, and but for the tail might easily be taken for the skins of that animal. It has no scent or musk that I can appreciate. I consider the flesh good eating, although it is not generally so esteemed by the people. The Indians eat them, and formerly made great use of them as food. Since the disappearance of the Indians from large sections of the country I think the show'tl is increasing in numbers. It is nocturnal in its habits, doing most of its excavating, feeding and moving about during the night. It is occasionally, however, seen above ground in the day time; when so seen it is extremely shy and wary, and will never be caught far from its hole. They move about considerably during the day time, as is evinced by being frequently caught in steel traps. They are pugnacious fellows, and will seize the nose of a dog, inflicting a severe bite. Enemies they have, no doubt, as minks have been caught in their burrows on the uplands, and wildcats, fishers, and other rapacious animals abound in their neighborhood.

I have found them associated with the digger squirrel (*Spermophilus beecheyi*), with which they seemed to be on friendly terms; indeed, the appearance and plan of the burrows of these two ani-

mals are very much alike, being frequently started under an old log and continuing under the same for its entire length.

They do not hibernate, but keep their burrows open all winter; beaten trails in the snow are often seen, leading above ground for a few feet, from one hole to another. They are able to gather their food at any time of the year, seldom going more than a few feet from the entrance of their holes to procure it.

I have never heard them make any kind of noise by day or night, save a kind of growl when caught in a trap. They are easily caught in steel traps, to the contrary of what many with whom I have conversed assert. I have caught numbers of them without even covering the traps. The No. 0 "Newhouse" trap is the one I have used. They are quite strong, and generally break their legs; and, if long in the trap, will be found dead.

A friend of mine had one domesticated for several months. It readily ate apples and other fruit, vegetables, etc., and seemed to bear confinement very well. It took great pleasure in paddling in a dish of water; slept most of the time during the day, but awakened to activity as night came on. Another man caught one while young, and let it run about the house. As it grew larger it dug a hole in the ground near the well, where it lived contentedly for a long time, when a strange dog killed it.

My knowledge respecting the breeding of the show'tl is limited and uncertain. People living in the vicinity of these animals tell me that the young show'tls just weaned make their appearance during the month of June, in numbers from three to five at a birth. The females have six teats. From my present knowledge of them I suspect they breed but once a year, like the beaver.*

——:o:——

THE MICROSCOPE AS A MEANS OF EXAMINATION OF ROCKS AND FOSSILS.

BY DR. R. FRITZ-GAERTNER.

THE examination of rocks in regard to their lithological character is accompanied with great difficulties whenever their composing minerals are so minute and so thoroughly intermingled

* On the habits of this animal compare also: *Coues*, Monograph of Rodentia of North America, 1877, pp. 590–598; *Matteson*, Am. Nat. XI, 1877, pp. 434, 435; Murphy, London Field for May 5, 1877.—E. C.

with each other that one even by aid of the magnifying glass cannot recognize them.

A compound rock of such minute structure may appear to be a homogeneous one, as the individuality of its minerals is lost, in comparison with the whole appearance of the rock. The chemical analysis of the compound will not furnish an adequate representation of its mineralogical composition, but will only give some figures of its elements, after which we classify the rock under examination by comparison with a group of rocks, with which it has the greatest resemblance in its chemical composition. At the same time we have to remember that there are rocks which are of the same chemical composition, and yet their mineralogical constituents are different from each other. True, chemical investigation has helped us to gain some valuable points according to which we may form some idea of the composing minerals, but not of their physical qualities, *i. e.*, in which state of molecular arrangement they may be, and how they adhere to each other. Chemical analysis is therefore not a complete survey of the lithological nature of the rock; the task laid upon chemistry by lithology was too heavy, as the former destroys the architecture of our mineral aggregate, instead of examining it. We should therefore not wonder that this result of chemical investigation could not be used as a firm basis for lithology and geology.

A great number of rocks, mineralogically different from each other, were treated and named according to their chemical composition as one kind of rock, whilst lithology on the other hand unnecessarily enriched its nomenclature by giving to one and the same rock (the structure of which presented itself in various forms) different names.

The study of palæontology without the aid of the microscope was limited, as it could only treat, in its description, of facts visible to the eye. We know by experience that nature by the process of petrifaction has not only preserved the macroscopical forms and organs of those fossil organisms, but also their microscopical one. These minute remains whether only organs of a macroscopical fossil or an organism by itself, rightly deserve to be studied with the same industry and endurance, with which their larger fellow organisms are favored; the more, as we know that the microscopic organic world takes and has taken an important position as architects of the sedimentary rock of our earth. The researches of the palæontologist enable him to meet

with forms of which it is difficult to decide without the aid of the microscope and some preliminary preparation of his material, whether they have to be treated by the lithologist or palæontologist. A chemical analysis will not disclose their origin, whether by mineral accumulation or organic life. Usually they are left to the lithologist who, not long ago, claimed all the fossils as freaks of nature. A great number of those interesting forms are generalized with oolites, concretions, etc. The unsatisfactory results obtained by the limited macroscopical and chemical analysis of rocks and fossils, induced Dolomien and Cordier in the last century to advocate the use of the microscope as a necessary and important instrument for investigations in geology. But their efforts failed to secure to the microscope an acknowledged position in the laboratories of the lithologist and palæontologist. This failure has to be principally attributed to their defective mode of preparing the rocks for the microscope. The examination of the rock consisted mainly in viewing its natural fracture or polished surface by aid of reflected light, as the opaqueness of the material did not allow the use of a transmitted light. This imperfect method could not be of much service.

Another method of preparing rock material for the microscope was to crush it to a fine uniform powder, which by decantation with water was deposited according to its specific weight. The minerals composing a compound rock being of different specific weight, they separated in beds or layers, which contained principally one and the same mineral. The minuteness of the powder allowed it to be viewed under the microscope with transmitted light. In most cases the minerals could be recognized either by means of the magnifying power or by aid of chemistry, which analyzed the separated layers by themselves, but which in reality do not always consist of fragments of the same kind of mineral, but are also partially mixed up with each other. The chemical analysis could not be entirely depended upon, but had to be verified by microscopical observation. The greatest drawback to this method of rock analysis is the entire loss of structure during the grinding process. And although Ehrenberg, by this method of examining rocks in form of dust, achieved his famous results of the micro-fossil organs of the chalk formation, yet the microscope remained for a long time of only limited use.

The great reorganization of lithology which has recently been

accomplished by Sorby, Zirkel and Rosenbush may be attributed to the introduction of thin sections of rocks for microscopical analysis. These sections are ground thin enough to allow the use of transmitted light, and although but a small slice of a rock be examined, it reveals their composing minerals and their structure and also their accessory aggregates.

The structure and means of cementing of rocks is clearly represented in the various sections made in various directions.

The base of a rock is by aid of the polariscope readily decyphered, whether it be crystalline or amorphous. The base of porphyry is composed of minute particles of feldspar and quartz. Basalt was found to contain sometimes enclosures of a glassy character, which in many cases are so large that they assume the aspect of a base through which the crystalline part is scattered, and rocks which were always considered as amorphous, were shown by aid of thin sections to be in a state of crystalline formation.

One of the most interesting features of lithology is the chapter treating of the cause and result of metamorphic changes in rock. A section of an altered rock presents in itself the whole story of a process which for a long series of years must have been working to produce a chemical and physical alteration in those solid bodies. We learn by the study of the thin section with the microscope, which of the composing minerals was at first disturbed and changed, and how the progress of change in the molecules was gradually spread through the whole mass. The well-known rock, serpentine, may illustrate this. A section presents outlines of crystals which are on the borders serpentine, but which in their centre enclose a clear and unaltered nucleus of chrysolite, the remainder of the chrysolite crystal, the form of which is preserved in serpentine. Further, basalt carries chrysolite as one of its most common accessory minerals. Nearly all these chrysolites are in a state of metamorphism, their outlines showing bands of serpentine, similar in structure to the serpentine occurring in large masses and the origin of which has been found to be in a compound rock changing by the chemical and physical alteration to a homogeneous one.

A careful microscopical study of rocks and minerals of a country enables us also to trace the original rocks which furnished those immense layers of drift clay, which when prepared for the

microscope appears as a mass of debris of rocks altered by mechanical means and pseudomorphical actions.

The study of thin sections of rocks has also widened our knowledge of the more frequent occurrence of certain minerals as micro-mineralogical accessories, as magnetite, menaccanite, apatite, hornblende, tourmaline, nepheline, nosean, microlites, and many others.

It is also due to microscopical researches that crystallography and mineralogy have been abundantly enriched in facts which may be of the greatest importance for their development as sciences. What we formerly thought to be a single crystal has shown itself as a number of crystals in position of twin formation. A great number of crystals, principally quartz, have been found to be porous, the pores filled with liquid, most likely water and carbonic acid, and these pores are the most frequent if quartz occurs in granite or syenite.

Orthoclase presents under the polariscope two systems of bands crossing each other at right angles. Labradorite is filled with menaccanite and magnetite; and mica and magnetite generally pierced with apatites when occurring in granites, or in diorites.

It is not the intention of the writer to describe all those results of micro-lithological researches which within a few years have reorganized lithology and richly contributed to geology, mineralogy and crystallography. The remarkable work of Prof. Zirkel, forming the sixth volume of the Report of the United States Geological Exploration of the Fortieth Parallel, under the direction of Prof. Clarence King, Geologist-in-charge, will demonstrate at once the importance of thin section in lithological researches.

Palæontology likewise has derived a great many new facts, as will be seen in a forthcoming volume of the "Palæontology of the State of New York," by Prof. James Hall. A great number of sections of corals and sponges and other fossils have been prepared and illustrated. The result derived from its perusal will show that palæontology also has progressed as much as lithology by the adoption of thin sections and the microscope as a means for the study of fossils.

THE SPRINGS OF SOUTHERN NEVADA.

BY D. A. LYLE, U. S. A.

IT is the intention of the writer to merely jot down a few personal recollections of some of the springs visited in the arid region of Southern Nevada, while a member of one of the Wheeler expeditions.

To those who have experienced the pangs of thirst, while journeying over the desolate wastes that characterize this section, it will not be surprising that reminiscences of water should linger longest in the memory of the traveler. In fact the procurement of that necessity is a matter of such vital importance that all movements are subordinated and controlled by the answer to

Fig. 1. Mud Spring.

the question, "Is there any water there?" Should the reply be in the negative, some other route must be followed, or else a supply of water must be carried along. The springs in this portion of the Great Basin are few, and often far between. Their waters differ much in quantity, temperature and chemical composition. In quantity, the yield varies from a few gallons per day to a never failing supply. As to temperature, the heat of the waters range through cold, cool, tepid and warm to boiling. As regards chemical composition, some are fresh, others alkaline, and still others, sulphurous. In the waters of some springs, a mere trace of saline ingredients are found, while in other cases the salts are present in sufficient quantity to produce saturation.

The first that will be mentioned are Mud Springs (Fig. 1), also

known as Desert Wells, from the fact that parties passing that way, have dug pits from four to eight feet deep when there, in search of more water. These springs, when visited by the writer, were mere pools of muddy slime, with a slight film of stagnant water overlying the viscous blue marsh. So nauseous were these waters that neither men nor animals could drink them. Enough water, however, was obtained by digging new pits or "wells" near by, to partially alleviate the sufferings of man and beast, which were somewhat intense after marching over thirty miles through the heated sands of the Smoky Valley Desert upon a July day.

These springs—if springs they may be called—were situated at the southern extremity of Smoky Valley surrounded by a dreary waste of sand and "alkali flats," with here and there a stunted sage bush.

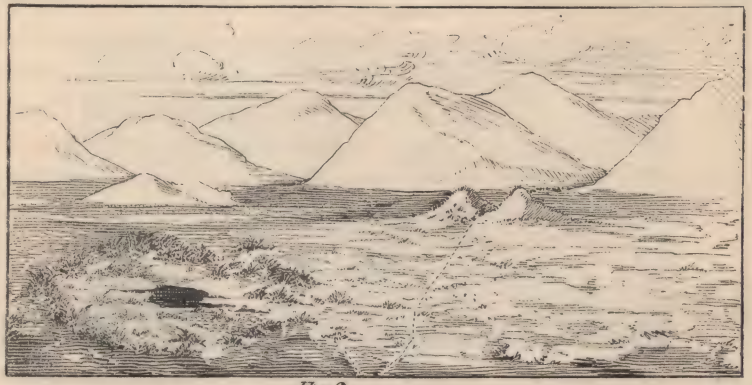

Fig. 2.

Day break the following morning found the party en route to Silver Peak, the next objective point. Silver Peak, a small mining camp, is located near the west side of Clayton Valley, and at the eastern base of the Red Mountain range. Near this place and along the western border of the salt marsh which forms the major part of the basin are the Thermal Springs. The more important ones are eleven in number. With one exception they are contained in a narrow belt, running almost north and south. This belt is about a half mile in length, its width being but a few rods. Beginning at the southern limit of this line, the first spring we encounter is in a small depression in the general surface. (Fig. 2.) Its waters are slightly saline, but quite palatable, and are the best for use in the vicinity. The

temperature of the water is 69° Fahr. Just north of this is found a cluster of springs; the largest and most central one is called Saturn. (Fig. 3.) Their temperatures are 69.5° Fahr. These springs are in close proximity to each other, and flow out upon a level area some twenty acres in extent, covered with a rank growth of coarse salt grass, from whence the water flows into the salt marsh.

Proceeding northward, we next meet with three salt springs arranged in the form of an isosceles triangle, differing widely in temperature and the degree of their saturation.

These are situated in the edge of the salt marsh, the two forming the base, being in an east and west line, twenty feet apart. The more westerly one has a temperature of 79° Fahr., while the other one in its quiescent state has a temperature of 117.8° Fahr., and at irregular intervals boils and emits steam. The third,

Fig 3 Saturn Spring.

forming the apex of the triangle and lying ninety feet north, has a temperature of 116.5° Fahr.

Still further north are two more salt springs, situated also in an east and west line, only four feet apart; the westerly one, as before, having the lowest temperature, being 79° Fahr., while the other has a temperature of 117° Fahr. Another spring (Fig. 4), about one fourth of a mile north of the others, was constantly boiling and emitting steam. A gurgling noise could be heard in several places near the main opening, under the tufaceous crust of calcareous matter deposited by its waters. In approaching this spring the greatest caution had to be exercised to avoid breaking through the crust of tufa which bridged and in part, concealed the seething waters, which could be seen through the many perforations in this treacherous envelope. Every step in

advance was carefully tested by striking the tufa with a mining hammer, to see if it would bear the weight of a man. Thus, by slow degrees one or two members of the party succeeded, without accident, in reaching the main opening, which was about five feet in diameter. Regard for personal safety, however, soon overcame scientific curiosity, and the retreat was accomplished by separate routes in the same cautious manner, to avoid getting too much weight upon any one place. The waters were found to be impregnated with soda, lime and borax.

In the immediate vicinity of the hot springs were found numerous concretions, either on the surface or slightly imbedded. These had generally a prolate spheroidal form, although many eccentric shapes were seen. About half a mile out in the salt marsh was a remarkable spring (Fig. 5), nearly twenty feet in diameter. The water rose to the height of several inches above

Fig 5. Boiling Spring.

the general surface, and was retained by a ring of earth elevated a foot above the terrain and thickly set with *tules*, a kind of rush, whose verdancy contrasted strangely with the sombre gray around, and gave to it the appearance of a miniature oasis. The water was quite clear and nearly fresh; this latter property was probably only apparent from the contrast, after imbibing the more brackish water of the other springs; its interior cylindrical walls extended to a depth of about five feet, below and under which, as far as could be reached by a pole, nothing like earth could be felt. There appeared to be a subterranean lake beneath the salt-marsh, of which this spring was the only visible portion. As to its depth we had no means of determining it; the temperature was 69° Fahr. The circumjacent earth was a mere superficial crust, five or six inches thick, which was springy beneath our tread, and breaking through which one sank into the viscous

mud. In walking over this area the ground constantly jarred and trembled, thus indicating the elasticity and instability of the indurated envelope. Even on the road near our camp, west of the marsh, when animals traveled over it, a dull, hollow sound was heard, bearing out the hypothesis of the existence of a subterranean cavity. The plain is crossed in two or three places by roads and trails; and should animals get off these, they break through and often become submerged in the mire. At one or two places shallow trenches or vats have been scooped out, and the salt water collecting and evaporating in them leaves the walls and bottoms covered with beautiful crystals of pure salt.

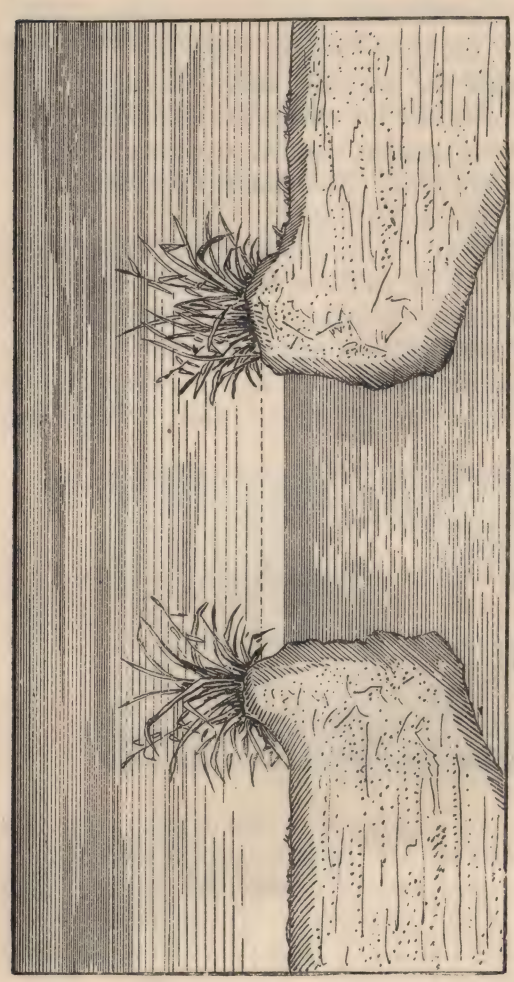

Fig. 5. Section of Spring in Salt Marsh.

Traveling westward from Silver Peak, a distance of eleven and three-fourth miles, during which the Red Mountain range is crossed, Mountain Spring is reached. This spring bubbles up at the foot of Red Mountain peak. The water is clear, cold and not in the slightest brackish. Its appearance was hailed with joy by men and animals. At last water had been found that would slake instead of increasing thirst. Here, in the short interval of less

than ten miles, the physical characteristics of the water supply had radically changed.

On the east side of the Red Mountain range the springs were thermal, brackish, and often nauseating, while on the western slope they were pure, cold and refreshing.

A few miles west of Red Mountain Spring, in a dry ravine,

Fig. 6. Mamie Spring.

through which the traveler passes to reach Fish Lake Valley, is found Mamie Spring. (Fig.6.) The water is excellent and plentiful. Its situation is rather unique. In the bottom of a dry wash lies

a very large boulder of conglomerate, or more strictly of breccia, transported from some distance, from the under side of which the water of the spring gushes into a little pool or basin it has made for itself. From this basin the water, overflowing, traverses for a few yards the gravelly bed of the wash, when it sinks and is seen no more. The huge boulder that shadows this little basin with its overhanging edge is mainly composed of a very hard arenaceous matrix, in which are seen imbedded many rounded pebbles of various sizes, and also large angular fragments of rock. The most remarkable thing about this spring was the fact that it had only been running about two years, having suddenly sprung into existence, the miners said, since they had been in the vicinity.

Fig. 2. „Mound" Springs.

Upon the eastern edge of the Amargoza Desert is quite a large area called Ash Meadows; so named from a small species of ash tree growing there. The meadows are covered with good grass and are well watered by numerous warm springs.

The principal spring was about thirty feet in diameter and situated at the foot of a small butte. The water issued from the bottom, through a tufaceous mass of rock.

It was about four or five feet deep and was cooler than the other springs. The stream of water that flowed out was five inches deep and two feet wide, and clear as crystal. The sides and bottom of this spring were covered with a white, chalky-looking deposit, that gave a milky tinge to the water when stirred up. A few small fish were seen in this spring. Many of the springs in this vicinity contained quicksand.

Fig. 8. Las Vegas Springs.

South-east of Amagoza is Pah-rimp Desert. About the middle of the upper end of this dreary waste of sand and sage bushes are several little oases bountifully watered with exhaustless springs, some of which are very large, and the confluence of their waters forms quite a large creek that flows off towards the south-west, but is soon lost in the sand. Splendid grass abounds along the banks of this water course. Immediately around the springs a band of southern Pah-Ute Indians is located, and by irrigation succeeds in raising a quantity of corn, squashes and watermelons. Willow trees and wild grapes are indigenous, the latter growing in the greatest abundance.

Mound Springs. (Fig. 7.) By this appellation it is proposed to designate those springs situated upon small mounds rising above the general surface of the country surrounding them. The most prominent mound noticed by the writer was upon the Vegas plains in Southern Nevada; its base was circular and

about twenty-five feet in diameter, it was fifteen feet in height and was covered with "*tules*" and coarse grass. Several small sulphur springs oozed from its nearly flat top, and provided moisture for the tangled vegetation.

It appeared as if built up by the partial decay of organic matter and the depositions of these numerous springlets. The soil was tremulous and yielding to the tread, and resembled in that particular the sphagnous bogs of Alaska. The fumes of sulphuretted hydrogen were strongly apparent even at some distance from the mound.

A short distance beyond the mound above-mentioned, occurred the Las Vegas Springs (Figs. 8, 9), the largest of which was ap-

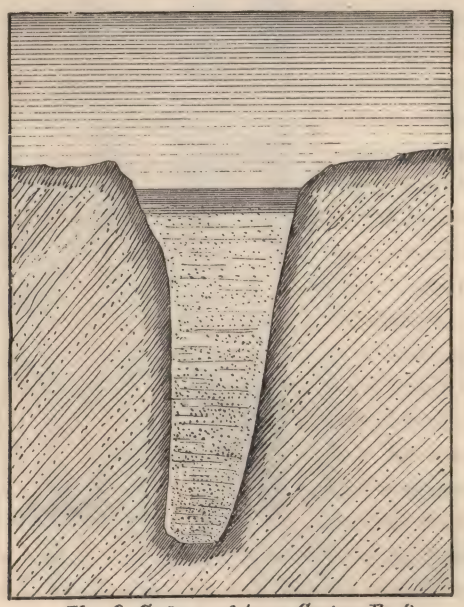

Fig 9. Section of large Spring: Fig 8.

parently about three feet deep, with white quicksand constantly "boiling up" from the bottom. Quite a large creek issued from it and ran in a south-easterly direction for a mile or more. This spring had been regarded by the Indians and squatters as a rather supernatural one, and among other improbable legends was said to be bottomless. This myth, at least, was exploded when a sixty pound weight tied to a cord was used to sound its depth. This weight sank eighteen feet and three inches through the ever

varying quicksands, and then came to rest. Further on ran the other springs which also poured their waters in the creek flowing from the first one. On the left bank of this creek stood an old *adobe* enclosure, rectangular in shape, built by the Mormons some years before.

Two or three large cottonwood trees shaded the creek near the quadrangle. Here the bed of the stream was broken into a series of little rapids or falls, none exceeding four feet in height, formed by rocks of calcareous tufa.

At the foot of these miniature waterfalls was a quiet pool, about five feet deep and ten feet in diameter, used in former times by the Mormons as a baptismal font. The land along the banks of the creek had been cultivated, and at this time were seen the remains of irrigating ditches, which attest the industry and enterprise of this strange, and to our minds, deluded people. These fields are now overgrown with mesquite and thistles, the latter attract numberless goldfinches, humming birds and humble bees.

In the springs above enumerated, the reader has a sketch of a few of those in Southern Nevada. The springs of this inhospitable region are so few, that at one time or another, each one becomes, as it were, the polar star of the desert traveler, towards which he turns his face with inflexible determination.

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THE NIGHT HERONS, AND THEIR EXODUS.

BY REV. SAMUEL LOCKWOOD, PH.D.

AMONG our showy birds, although far from graceful in many of its movements, is the night heron (*Nyctiardea gardeni* Baird). If fine feathers make a fine bird, then assuredly our *Nyctiardea* deserves consideration. The bird when adult is fully two feet long. It has a deep guttural cry, consisting of one syllable, slowly repeated. This circumstance afforded the old name given it by Nuttall, *Ardea discors*, as also its popular names of qua-bird, or quawk. It is also known as the black-crowned night heron, the crown of the head, and considerable of the back being a very dark green, almost approaching black. In the nuptial months, the bird flourishes from the hinder part of the head, flowing backwards, like so many natural "accidentals," three very delicate white

plumes, nearly ten inches long. If I might change the simile, these pretty white filaments are suggestive of the white streamers pendant from the chignon of some fantastic bride. And the two sets of adornments are afflicted with a similar perverseness; for the bridal toggery of the one will insist on getting twisted, and *Nyctiardea's* nuptial head-gear also will snarl into one. But in this instance the thing after all is quite natural and becoming. Each of these white, almost thread-like filaments, is nearly cylindrical, owing to an incurving of the edge of the feather; hence the three do have a habit of slipping into one another, and making, as it were, a pretty imbricated cord or cue of ivory whiteness. The general coloring of this showy bird is such as neither pen nor pencil can quite portray. Says Coues, who is a fine bird painter, when verbal pigments are concerned: "General plumage bluish-gray, more or less tinged with lilac; forehead, throat-line, and most under parts whitish." The bill is black, and the feet are yellow. You will find nothing verdant in the eyes of the night heron, although the space between them is of a greenish blue. As to the optics themselves, they are red. Does some one insinuate "that is the way with night birds?" Let such an one consider that generally the owls have bright yellow eyes.

It was three years ago, just as June, the busy bird month was opening, when, accompanied by two of our students, I set out for a visit to a famous heronry, some three miles in a south-west direction from New Brunswick, N. J. The neighborhood is called Three Mile Run, because of a tiny stream about that distance from the city. We went first to the farm house near by, where a colloquy something like the following occured:

Self. "Do you know when the herons began to settle over there?"

Hostess. "Well, sir, you see it is so long ago since the herons came, that it really is not possible to say when they did settle, but they've been there 35 years to my certain knowledge."

Host. "Oh, wife, more than that: I remember them over 40 years; and there was father, who had known them long afore that. I'll be bound that heronry is 50 years old if a day. And since I've known them they've come and gone every year, never missing once."

Self. "Is that all the woods there were?"

Host. "Bless you, sir, no. Once that was as pretty a piece of oak woods as one need put eyes on. It covered many acres, and

we called it the Swamp. Just that grove where the herons are is all that is left of it. We never attacked the birds, so I suppose they got to understand us, and to know that they were welcome. The felling the timber and tilling the land has pretty much done away with the swamps. You see, there's only about two acres in that grove. But the herons were a good deal more numerous when the woods were bigger."

Hostess. "Yes, I remember when it was a'most deafening to hear them."

Host. "When we see them coming back in the spring, we know that corn-planting is nigh; and when they leave in the fall, it is usually time to husk."

With the two young men I now started for the heronry, but five minutes' walk distant. It was evidently once a swamp. The grove was a remnant of a large wood of red oak, *Quercus rubra*, and, as already stated, did not cover quite two acres of land. With an exclusiveness not unlike that of some wasted Indian tribe, these red oaks kept out every other kind of tree. They even pressed upon one another so closely, that the lower branches after a precarious growth, inevitably died and fell. Atrophy of the lower limbs was the invariable habit. Thus the trees with a small girth pushed up towards the sky, each one a slim mast about fifty feet in height, with a small dome of shining green leaves at top, the base of each little dome crowding upon its fellows. It looked to me like a garden supported on piles; but as the wind sprung up there was such a wave-like movement overhead, that I wished for a balloon view, when I fancied I should see an emerald ocean floating in the air.

But if in mid-air was a scene of beauty, one of quite another character was soon to greet our eyes. Everywhere in the grove the ground seemed as if plashed with drippings of whitewash. And the leaves and twigs of the scanty underbrush were stained with these unsightly blotches of white. This was the effect of the droppings of the birds, both the old and the young. It indicated a large consumption of food; and if fish makes good brain food, perhaps this may have some bearing on the commendable circumspection of these occupants of the top flat in this establishment. I was led to look for some peculiar effect on the plant life of a soil so dressed annually for a half century. But I failed to detect anything noteworthy.

As we entered the wood there arose a grand commotion. An

old bird, perhaps the patriarch of the tribe, sprang into the air with a startling qua! which, after a pause as if to gather assurance, was repeated—Qua! qua! qua! Up flew another, and another, then many, all joining in the one wild out cry of qua! qua! qua! as they circled in air, loath to let their nests be out of sight. It was a wild chorus of alarm, utterly unmethodical, but perfectly uproarious, while over the edges of the rude nests of sticks peeped hundreds of little callow heads in mute astonishment, as if to see what could be below to incite so great a tumult above. Almost in the heart of that small grove I counted fifty herons' nests. These nests were high up in the leafy domes already spoken of. In some instances I noted three, and even four nests in one tree. Some writers I find saying that in the breeding season, the qua-bird is less suspicious. Assuredly it seemed to me that these herons could not be more circumspect. To come upon them by surprise was just impossible. From a distance no one can see them in their leafy outlooks, but they can see you; and should one approach too closely, the nearest male bird will give the alarm.

I noticed that the females whose incubation was not completed did not leave their nests. I have no doubt that they were waiting further signals from above.

Query: What notice of change in the situation can a bird give whose whole vocabulary is contained in the one monosyllable, qua? But do not philologists tell us that in some of the dialects of "The Flowery Land," that even a monosyllabic word may have eight significations if spoken in so many different tones? Thus if a barbarian outsider might be allowed to improvise a bit of barbarous Chinese, one might say shoò, to mean lovely, or all right; and shoó, to signify awake, or all wrong. And pray why not as much in the bird lingo?

Here let me mention an incident. Not knowing that one of the party was behind us making a feint of climbing a tree with a nest in it, there was observed an increase of commotion in the air. To a question what are the quas doing, the answer returned was: "They are taking a bird's eye view of the situation." I requested the aspiring youth whose conduct had intensified the stir above, to climb the tree and get a young one from the nest, that we might see it. Now began that change in the bird talk. It was qua! still, but in a different tone, and one which was understood by the sitting birds, for they spring from their nests and

joined their companions in the air. As the youth neared the nest the wild monotonous cry became painful to me, and I was anxious to shorten the suspense of the poor birds. Clinging to the tree with both legs and one arm, with the free hand he took a young bird out of the nest, and held it at arm's length from the tree, that I might see the callow thing, which was about as big as a fat squab. I saw it—yes, and I saw more than I looked for. The downy little beast vomited upon me the topmost layer of his night's feeding. And even my philosophy sold me, for concluding that the mischief was done, I stood my ground, but the mischief was only begun; for after an extraordinary pause, layer number two, in a more advanced stage of digestion descended, which in a hurried manner I declined to receive. After another pause, the third and last installment followed. We now called to the young man to put the unmannerly little thing back in the nest. It had thrown up the remains of six fishes.

The above incident was called "a sell," and subjected the writer to some chaffing at a later date. Said a wag, as if in quest of knowledge—"Why does a young qua-bird vomit his dinner upon being disturbed"? To this the answer was: "I do not get it from observation, but have it from tradition, that some of the herons when pursued by the raptors, keep up a series of diversions by vomiting the contents of their stomachs in installments, much as the Russian dispenses the contents of his sleigh when pursued by wolves." Now what the young heron did, was done from mere instinct—not offensively, subjectively considered, although objectively it was offensive enough—but as a protection by way of diversion. That is, the young bird acted wholly from an automatic impulse of instinct. And what is instinct but inherited experience after being crystallized into habit? In a word, the frightened young quawk, simply did in a blind way what its ancestors had done with better methods. If there had been enough intelligence in that instinctive act to indicate purpose, then the intention would have been as against the youth who held it as a captive, and not at all as against the spectator of the act.

Although they indulge in varied food, yet these night herons are nocturnal fishers, and their fishing must be limited to the margins of streams, and in waters decidedly shallow. They sally out at twilight, though sometimes if the day is cloudy and dull, they will not wait till then. As they pass near, and sometimes over the farm houses, on their way for food, they indulge in their

peculiar cry, the effect of which on the stillness of the night, is somewhat weird; still it is neither so ghostly nor so ludicrous as that of the classic bird of night. And very industrious must these night fishers be, for with a voracious appetite of their own, and a good deal of really hard work to be sustained, their young also consume an enormous quantity of food.

In connection with the fishing of the night heron, I found a very curious item of belief among these persons whose acquaintance with the habits of the birds of this heronry reached so far back It was this: that the quawk when fishing in the night stood in the shallow water watching for its prey, and was aided in the matter by a soft light which emanated from its legs and feet. We had heard of luminous understandings, but they belonged to the higher vertebrates. I was assured that this phenomenon had been witnessed, the observers being out coon hunting on a moonlight night, and I was asked if these birds had not the capacity of emitting light from some phosphoric source in the legs, in some analogous manner to the phosphoric emission of the fire flies, or lightning beetles. Having in a modest way expressed my doubt as to the phosphoric hypothesis, I ventured to suggest that the yellow legs of the bird when withdrawn wet from the water might have shone, reflecting the moonlight. But the phosphoric hypothesis held its ground, being regarded, and perhaps rightly, as the more erudite of the two.

My pupil, who climbed the tree to show me the young bird, a little later in that same season, secured one of the fledglings, which he successfully tamed. It became an interesting pet, though hardly of the amiable sort. It had the run of the premises, especially of the barn yard; and was blessed with the appetite of a glutton. To this insatiable craving, fowl, flesh and fish were alike acceptable. Though descended of kindred who had always wintered in the warm southern climes, the bird stood the winter, a severe one, admirably. In this way it met with experiences which were not at all inherited, and decidedly novel.

It hugely relished soft fresh meat when cut into convenient morsels. The same meat hung in the barn would get frozen. In this condition it had to be cut up with a hatchet. A bit of frozen fat thrown to the bird evoked conduct of a humorous character. Suspecting nothing, the bird went for the coveted morsel, when, after some queer contortions the half-swallowed delicacy would be suddenly eructed with the quaintest demon-

strations of astonishment and distress, much as a child who on an extremely cold day in winter, dancing with pain, complains that the door-knob has burnt his fingers. But though embarrassed by the situation, the young qua would repeat his efforts to get the frozen meat well down, until success resulted, when he would come for more; so that in this conflict of bird thinking, the judgment that the meat was good prevailed. In fact, this bird's experience with frozen meat was not unlike daft Jerry's first acquaintance with ice cream: "This pudding *is* good; but such a pity it got froze!"

A very impudent, bossy bird, did the young qua grow up. Through the winter months the arena of his daily exercises was the barn-yard, which also was the scene of occasional night activities quite annoying to the more orderly disposed denizens of the place. His movements, even when "feeling good," were always awkward, and in no sense graceful; while from the depth of his inner consciousness was evolved a conduct so absolutely graceless as to almost indicate a deep-seated depravity. He would pursue the domestic animals, harrying the poultry and the old dog, presenting his formidable bill to those who owed him nothing, not even their good will. He knew his young master well, and paid him a sort of deference which he did to no one else. But though there was a kind of attachment, affection there was none. In fact his master was simply his feeder, to whom he was drawn by a very active appetite; this craving for food satisfied, even his keeper was but little more to him than other folks.

At length the cold season was over, and my young friend was glad to know that he had wintered his charge safely. He had begun to speculate how much longer he would have to keep the young qua bird ere it would attain to the plumage of its parents. The spring is well advanced, and the pet is about ten months old. See it is looking skyward and southward. Nay, it seems listening. Sure enough, the cry of qua! is heard in the air. The herons are coming. That cry is from the avant courier of the returning community. As the young bird looks up it is evidently undergoing a change in its feelings. There is another cry as if from the second outrider of the approaching host. The pet heron seems well nigh beside itself. It has never seen the "sunny clime," but it has caught that mysterious passion, the semi-annual frenzy of these birds. Its bird nature seems suddenly developed —and the bird soul is now above pellets of frozen mutton, and

the communion of fowls and dogs. Now the qua cries are thickening in the air, and the herons are coming fast. All this is too much for the young bird, so he is on the wing too to join his tribe. Albeit kindnesses received, he has cut himself from the white man and his ways. One would like to know how, with his superior education, this young person conducted himself; also how those illiterates, the old quas, received him. Well, this much must be said, as affairs will prove in a few days—the youngster has rejoined his tribe on the eve of an event the most remarkable in its history, one which might afford scope for the best exercise of bird wisdom, whether inherited or acquired.

On my table, at this writing, lies a pretty egg, which seems to give inspiration for my task. It is really beautiful for its symmetry, also its one attractive color, with neither spot nor stain. The larger diameter is fifty-two m.m., or two and one-sixteenth inches; the lesser diameter is forty m.m., or one and nine-sixteenths inches. Of the color I should have said above, it is a lustreless, waxy pea-green; though some call it a sea-green. And what an interesting object it is to me! and how sad is this interest! At the beginning of June in our Centennial year, 1876, my pupil who acted as guide to the heronry, brought me this egg, and with it the startling intelligence that the herons had gone! The community returned at the usual time, and had begun nesting. It happened that trade being dull in New Brunswick, many operatives were out of employment, and of these, not a few spent their time in a wanton destruction of the birds. Some went to the heronry, although strictly private property, and near the homestead of its owner, and in despite of his earnest remonstrances, a few shots were fired in the heronry. I am told that not more than two herons were killed. Had this happened away from their nesting place that would have been of less moment. But here in their cherished home, it was too much for these birds, so timid, and so circumspect. But have birds feelings? Who can doubt it? Doth not God care for birds? Verily, "your Heavenly Father feedeth them." What a resolution was that taken by these birds, every one of them. And how grandly prompt the performance. Fitting hour it was too for so sad an act —they left their home in the night—thus disrupting the bliss of the nuptial month by accepting a homeless uncertainty. That entire colony abandoned the spot where they and their ancestors had dwelt for fifty summers. In premature maturity one mother

bird at least had been compelled to lay her eggs, and then must leave them behind. And this pretty treasure on my table is one of them. Interesting, was it said? Nay, is it not historic, a memento of this remarkable exodus of the night herons from their almost romantic heronry at Three-mile Run, New Jersey. Do you ask, "Did they hold together as in a well-ordered retreat? And did they establish a heronry elsewhere? Or did the dispirited community dissolve itself into the isolation of single pairs? And finally, where did they go?" Well, just these are the questions which we are aching to find out. Meanwhile, let this much go on the record, of the time, circumstance, and spirit of the exodus of this ancient colony of birds.

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VARIATIONS IN THE NESTS OF THE SAME SPECIES OF BIRDS.

BY DR. T. M. BREWER.

IN the present brief paper I propose to deal more with facts than with theories. I leave to others to make such deductions therefrom as may suggest themselves. When one cannot, to his own satisfaction, point out the reasons that can fully account for indisputable facts, it seems to be the safer course to be content with only taking cognizance of natural phenomena, just as they impress our senses. The legitimate scope of the naturalist is first correctly to describe isolated facts as they present themselves. To seek to investigate the laws that unite these, though always tempting, is not always safe. The homely advice: "Never to prophesy unless you know," is applicable to the case. There is no worse bondage to the student of nature than to be a slave to theory. The danger of a "little learning" is of its leading to unwarrantable deductions, and then the temptation to color facts to suit preconceived opinions may become one of the besetting weaknesses of our human nature, against which it behooves naturalists especially to struggle manfully.

From time immemorial the theory has been prevalent, and generally accepted, that the constructions of all animals, man excepted, are the inevitable results of a faculty called instinct. On the other hand it is claimed that all the constructions made by man are due to another faculty known as reason. To this I am

not prepared to assent without many qualifications. Thus broadly stated it is entirely inconsistent with innumerable facts. The architectural achievements of very many kinds of birds, their variations and their deviations, their skill, their wonderful adaptations to varying circumstances, all point to intellectual action much higher than a mere blind instinct. The wretched holes, the degraded lives, on the other hand, of the Papuans and the Australians are surely not evidences of reason, properly so called. Their homes are infinitely below those of nearly all the feathered tribes, and show no advance. A few years ago it was discovered by accident that within fifty years there has been a wonderful change in the manner in which the common house martin of Europe builds its nest. Formerly their nests were globular in shape, with a small rounded opening, hardly large enough to admit the parent birds comfortably. Such are all the old nests in museums, such the descriptions of all writers, half a century ago. These nests were inconvenient, only one bird could come at a time to the opening to be fed. Long before the young could leave their nest, they must have been uncomfortably crowded in their ill-ventilated and close quarters. Some time within the half century this entire species has made a great advance and wonderful changes in the whole style of their nest. Instead of a sphere, the nest is simply hollow, semi-oval, roomy, airy and comfortable, stronger in its attachments, with increased facilities for access, better protected, both from the rain and from enemies. Unfortunately no one observed just when this remarkable change in their architecture took place. We know not if it was gradual or sudden, or how long it was in becoming general. But surely no one can pretend that all this was the result of mere instinct! Wallace maintains that no bird can succeed in constructing a nest in the same manner as its congeners, if it has not first learned their method, either from its own parents or from others of its kind. From this it would appear that birds brought up in confinement, from their nests, cannot construct nests like those of their fellows who have always been at liberty. Without attempting to decide how far Wallace's theory may be well founded, I can give two instances that have fallen under my own observation, that have an indirect bearing on the general need of instruction in other things than making a nest. A young cedar bird fell from its nest and was so severely injured that it never obtained the use of one wing. It was fed from the hand and remained wholly dependent on the care

of its benefactor. It never would attempt to feed itself even with food all about it, and when it was transferred to other hands died of starvation in the midst of abundance. Nearly the same occurred with a young mocking bird, who always insisted upon having its food held to its mouth. The latter died young, but the cedar bird reached maturity, and was two years old without learning to feed itself.

It is contended by some naturalists that the nests of young birds are invariably poorly made and not well situated. This, however, is a belief that it would not be very easy to verify. That birds of the same species do not always build their nests alike, that under varying circumstances they will vary their style in a very remarkable manner, is a matter of not unfrequent observation. Thus the cliff swallow, in wild tracts of country, and in its original haunts, constructs, with much labor, a long nest, shaped like an inverted retort, with the entrance from below. On Green Island, one of the Grand Menan group, I saw a large colony availing themselves of two boards put up for their convenience, and about half a foot apart, under the eaves of a barn, and all building open cup-shaped nests as unlike their typical nests as can be conceived.

In the last number of the Nuttall Bulletin, Mr. Brewster contributes a very interesting paper on the nesting of the yellow-throated warbler, *Dendrœca dominica*. The nest found by Mr. Brewster was on a stout horizontal branch of a southern pine, set flatly on the limb. It was a well made—an unusually well made nest, the framework being a few twigs and strips of bark into which had been worked a beautiful soft felting of moss and silky down of plants, all neatly and firmly compacted. I have seen the nest and am inclined to the opinion that it is probably the typical style of this bird, whenever it builds in a region where the abundance of the Spanish moss does not tempt it to make use of that growth, and there to build a totally different nest, with no other framework than the long fibres of the moss afford. In the appendix of the Ornithology of North America, I refer to several nests of this bird built in this latter manner, taken by Mr. Norwood C. Giles, of Wilmington, N. C. Several of these nests were obtained and well identified, and sent with their parents to the Smithsonian. Unaware of this positive identification, Mr. Brewster very naturally infers that Mr. Giles must have been mistaken. But this was not so. His identification was complete, and only adds another re-

markable instance of variation in the mode of nest building by the same species. The history of several of our North American birds also affords abundant evidence that it is by no means safe to assume that the same species may not exhibit a "great difference in the position and structure of the nest," under varying circumstances.

The recent observations of Dr. James C. Merrill (MSS.) shows that the *Icterus cucullatus* displays quite as striking variations as this warbler. Some of its nests, like those of the latter, are buried in tangled and elaborately interwoven masses of the Spanish moss, and have no apparent resemblance to others built in the more normal pensile style of its congeners, such as the orchard oriole and others. So, too, with the nests of the *Empidonax acadicus*. The first identified nest of this species I ever saw was a flat platform, so common in *Contopus borealis*; and this is its usual style about Philadelphia. The second was a deep cup-like nest, surrounded and surmounted by a curious chevaux-de-frise, somewhat in the style of the magpie and the mocking-bird. This style is common in Indiana. And now within a few months, I have received two other nests equally well identified, one of them with the eggs, the nests being pensile and not unlike those of the orioles. Such facts as these warn us that we need not and should not, on too slight grounds, discredit either the carefulness or the truthfulness of our fellow-workers in observing the hidden and often varying facts of natural history, even when their observations do not accord with our own. The account of the nesting of the *D. dominica* given by Mr. Nuttall has always seemed in the last degree improbable, and to be in conflict with that of Mr. Audubon, and their discrepancy has long been a stumbling-block to students until more light began to be thrown upon its history. Mr. Giles' revelations gave us some clue to what seemed the fabulous narrative of Mr. Nuttall. For when we remember how closely together stand the trees in a cypress swamp, how the long "ropes" of *Tillandsia* do swing from tree to tree, we can now understand how Mr. Nuttall, having never seen it himself, may have imperfectly understood the information he received from another in his account of its swinging nest. And now Mr. Brewster confirms substantially Mr. Audubon's discredited account of his experiences. After all, these pioneers in American ornithology may not have been so absurdly inconsistent, or so entirely at fault as we, in our own ignorance, have taken for granted.

I might go on and prolong this article by other accounts of conspicuous variations made by the same species in its nest-building, citing the lammergeyer that builds indifferently a huge nest on a tall tree, or lays its eggs on the bare ground or some tall cliff, without any nest at all, but I have given enough to show how marked these variations often are. To speculate on the whys and the wherefores would be a very tempting theme were it not that we are so often at fault in attempting to explain them. But I do not believe it is logical to call the intellectual promptings that inspire these variations mere instinct, though we may not be able to read clearly the hidden motives. If experience taught the European martin that its old-fashioned nest, which perchance it had built since the flood, was inconvenient, ill-ventilated and unsafe, and they were prompted by the example of some wiser intellect among themselves to improve upon the hovels of their fathers, so that all at once the whole race made a long stride in improvement, can we call this instinct? Grant that the changes have been slow—extending over fifty years—so gradual that no one has noticed the change while it was going on, we cannot deny the advance, and advance is inconsistent with our ideas of instinct which is unchangeable and incapable of education. It is a clear case of reason and instruction, yielding marked fruits, and is on a higher plane. That birds like the *Dendræca dominica* and the *Icterus cucullatus* build a typical nest, like their congeners, where nothing tempts them to do differently, but where the long branches of *Tillandsia* offer a safe shelter and the absence of labor, shows something higher than instinct, there must be a rational intellect that prompts them to avail themselves of the opportunity.

If we cannot understand what it can be that stimulates an *Empidonax* in Staten Island to build a pensile nest, while its fellow in Indiana builds one like a deep cup and surrounded with thorns, and another group in Pennsylvania put theirs on an exposed tree-top, and so flat that the eggs seem liable to roll out, we must see that some cause, hidden to us, is gradually effecting changes that sooner or later may become universal in the species, though which it is to be we may not be able to imagine.

Our eastern song-sparrow's natural instinct prompts it to build on the ground. A series of disasters to its eggs or brood impress it with the need of a safer place. It draws nearer the friendly shelter of a dwelling, and there, no longer on the ground, but up in some thick bush or vine, it makes its nest. For want of the

tufts of grass or weeds that furnished it with a roof, it changes its whole shape and builds a bulky, nearly spherical, domed nest. Some of its offspring adopt the new style of their parents, but others fall back upon their original style. The latter may be considered the promptings of a natural innate instinct, but the domed nests, the changes initiated by the parents and imitated by the more enterprising of their offspring are due to a higher intellectual power that rejects the blind suggestions of their original instinct, and teaches them to follow the paths of experience to safety. This is no imaginary case, but rests on facts within my own observation.

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THE RELATION OF ANIMAL MOTION TO ANIMAL EVOLUTION.

BY E. D. COPE.*

THE origin of variation in animal structure is, *par excellence*, the object of the doctrine of evolution to explain. There can be little doubt that the law of natural selection includes the cause of the preservation of certain modifications of preëxistent structure, in preference to others, after they have been brought into existence. In what manner or by what process the growing tissues of young animals have been so affected as to produce some organ or part of an organ which the parent did or does not possess, must be explained by a different set of laws. These have been termed *originative*, while those involved in natural selection are *restrictive* only.

I.

Of course we naturally look to something in the "surrounding circumstances" in which a plant or animal is placed, or its "environment," as the most probable stimulant of change of its character, because we know that such beings are totally dependent on cosmic and terrestrial forces for their sustenance and preservation. The difficulty has been to connect these forces with change of structure as *originative*; to show their operation as multiplying, restricting or destroying organisms already in existence is comparatively easy. This difficulty is partially due

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to the fact that such modifications must be realized during a limited portion of the life of an animal at least; that is, during the period of growth, when it is not at all or but little subject to the influence of external environment, but is usually protected or supported by the parent.

That the environment and changes in it affect the movements of plants and animals is clear enough. The potency of such changes may be read in the physical history of the earth. A long series of modifications preceded the advent of life upon it, and change, both gradual and sudden, has been exhibited in the configuration and climate of all portions of the surface of the globe since that period. Animals have again and again been called upon to face new conditions, and myriads of species have fallen victims to the inflexibility of their organization which has prevented adaptation to new surroundings. But it is evident that if change of environment has had any influence in the progress of evolution, it has not been alone destructive. It has preceded life as well as death, and has furnished the stimulus to beings capable of change, while it has destroyed those which were incapable of it. It is a truism that change of physical conditions has preceded all great faunal changes, and that the necessity for new mechanism on the part of animals has always preceded the appearance of new structure in geologic times.

The embryology and palæontology of vertebrated animals show that the primary steps in the progress of this branch of the animal kingdom are marked by the successive changes in the structure of the circulatory system. First we have the various mechanical methods for the aëration of blood in a watery medium; the result being a fluid whose metamorphosis in nutrition produces no heat. After the fishes followed *Batrachia*, the earliest air-breathers, whose long tarriance to-day in early aquatic stages, is an epitome of the necessarily "amphibious" character of air-breathing vertebrate life, when land and fresh water, in constantly changing areas, were rising and separating from the universal ocean. The successive disappearance of the traces of the fish type of circulation in *Batrachia* and reptiles, are familiar facts; and the exclusion of the unaërated blood from the systemic circulation in the birds and mammals marks the increase of general temperature which gives those classes one of their claims to superiority.

The appearance of land of course furnished the opportunity

for aquatic animals to assume a terrestrial life. Marine animals which had acquired the habit of gulping air from the surface, which some of them now possess, perhaps because its richness in oxygen produced an agreeable exaltation or intoxication, would not find visits to the land difficult. And this would naturally follow the necessity of escape from aquatic enemies, or the search for new supplies of food.

In fine, it requires little argument to show that the environment has had in the past as in the present, a primary influence over the movements of animals.

II.

I will now endeavor to exhibit some reasons for believing that the movements of animals affect their structure *directly*.

There are two alternative propositions expressive of the relations of the structures of animals to their uses. Either the use or attempt to use preceded the adaptive structure, or else the structure preceded and gave origin to the use. The third alternative, that use and structure came into being independently of each other is too improbable for consideration in the present article. Many facts render the first of these propositions much the more probable of the two.

A general ground for suspecting that movement affects structure is the fact well known to systematic zoölogists, that adaptive characters are the least reliable in systematic classification, *i. e.*, are the most variable. What we call adaptive characters are those whose teleological significance we can most easily perceive; those whose uses are at the present time most obvious. Systematists habitually fall back on characters which are apparently the least related to the ordinary necessities of the life of the animal, and this not from any theoretical considerations, but because such characters are found to be the most constant; this is a very significant fact, showing as it does that it is the adaptive structures which are undergoing modification to-day. And this truth can doubtless be discerned in all past ages, for many of the structures which are not now more related to the needs of an animal than many others might be, were at one time most essential to its well-being, or necessarily related to its environment. Such are the structural characters of the heart and arteries already enumerated. There seems to be no reason why all *Vertebrata* might not exist with equal comfort and success at the present if possessed of a

uniform organization in this respect. But the successive modifications which they present were, in past ages, most intimately connected with the progressive changes of the medium in which they lived, as to the volume of oxygen supplied for respiration, as compared with that of the vapor of water, carbonic acid gas, etc. But it must be here noted, in passing, that there are many structures in animals which have never been adaptive, but which are simply due to excess or defect of nutrition following a redistribution of force.[1]

The most direct evidence in support of the view that motion affects structure directly, is to be found in the well-known phenomenon of the increase of the size and power of all organs by use. This increase is limited in the adult animal by the general fixity of all the organs, so that one of them cannot be developed beyond a certain point without injury to others, or without exhausting the source of supply of nutritive material or special force derived from other organs. The syncope of the gymnast is an illustration of the natural limitation to the development of the muscular system which proceeds at the expense of the digestive and circulatory. But effort and exertion may become a habit of mind, which even if limited in its executive means, is probably inherited by offspring like all other mental traits. Such a quality possessed by an infant or child doubtless tells on the growth of its organs during their plastic stage, and produces structure by growth which is impossible to the mature body.[2] And no one knows as yet how far mental bias, may affect the nutrition of the parts of the infant in utero. Certain it is, that if use modifies nutrition in the adult, it must have still greater influence in the young; and it is in the young that the changes which constitute evolution necessarily appear.

Change of structure during growth is accomplished either by addition of parts ("acceleration") or by subtraction of parts ("retardation").

Acceleration is produced either by multiplication of parts (as cells or segments) already present ("homotopy"), or by the transfer of parts (cells) from one part of the organism to the other ("heterotopy"). Homotopy or repetition is the usual and normal mode of acceleration; it may proceed by an "exact repetition" of the parts already existing as in the simplest animals and

[1] Method of Creation, 1871, p. 23.

[2] In man these changes are chiefly produced in the brain.

plants; or the new parts may differ from the old, as in higher animals, where the process is called "modified repetition." Where new forms traverse in their growth all the stages in which they previously existed, they necessarily present at each stage the characters of those forms which have remained stationary in them, and have not changed. This relation of "exact parallelism" is the result of the simplest form of evolution or "palingenesis." When the history of growth of an advanced form does not show an identity between its stages and the various undeveloped or lower adult types, the relation is termed "inexact parallelism," and the type of development "cœnogenesis."

Change of structure is seen to take place in accordance with the mechanical effect of three forms of motion, viz: by *friction*, *pressure* and *strain*. Under the first two, epidermal tissues become both dense and thick, as is seen on the palms and soles of the hands and feet and in corns. There is no doubt that strength of the teeth is intimately connected with the hardness of the food. Density of osseous tissue and the coössification of parts of the skeleton, are directly associated with the force and duration of muscular contraction. Pathology abounds in illustrations of the determination of nutrition to new localities to meet the exigencies and demands arising from new stimuli. It is only necessary for a structure-producing supply of nutritive material to be habitually determined to a new locality by oft recurring stimulus, for the movement to become automatic and reflex; and such a tendency would sooner or later be inherited, and produce structure in the growing organism of the young to a degree far exceeding anything that is possible in the adult.

In view of the above considerations, we can ascribe an extensive class of osseous projections at points of muscular insertion, to the strength and duration of muscular contractions. To the same cause may be ascribed various anchyloses, such for instance, as is seen in the foot of the sloth. Transverse strains or their absence may be looked upon respectively as the cause of the hinge-like or immoveable articulations of the segments of the limbs of vertebrate animals. It is well known that in land animals, where easy flexibility of the limbs is essential to speed, that these articulations are highly developed, while in marine animals where the limbs are only used as paddles, they are almost or quite inflexible, and the extremities of the bones are truncate. In the most highly organized land mammalia, the tibio-tarsal, and humero-cubital

articulations display an interlocking or tongue and groove character. The same thing is seen in the ulno-radial fixed articulation in the same types. These arrangements are especially adapted to prevent dislocation by side strains, and if the preceding explanations be true, this structure is a corrugation due to the lateral pressure of a more or less convex surface, on a concave one which embraces it, and vice versa.

In the circulatory system pressure has doubtless played an important part. Increased oxygenation of blood, the necessary consequence of the purification of the atmosphere, would stimulate the action of all the organs, including that of the heart. Greater pressure on its walls and septa would increase their size and strength, and ultimately close such foramina as were not in the course of the blood current; as the *foramen septi ventriculorum* of reptiles and the *f. ovale*. Increased force of the current would, on the other hand, soon cause the enlargement of one or other of the four or five pairs of primary aorta bows, and develop it at the expense of the others, until finally the pre-eminence of one channel be secured and the aorta be the result. This part of the subject might be prolonged to an unlimited extent, but the above illustrations must suffice to indicate the meaning of my propositions.

III.

That movements change the environment of a plant or an animal, or parts of them, is obvious enough. If we consider only the reflex class, to which all the movements of plants and many of those of animals belong, we perceive that but for them the ordinary functions of assimilation, circulation, etc., could not be performed; there would be no change in the contents of their tubes and cells, and the environment of these would be unaltered. But when we view the movements of the higher animals, we perceive the immense importance of the powers and organs of movement as a factor in evolution. It may be safely assumed, that without powers of designed or adaptive movement, life would never have advanced beyond the stage presented by the vegetable kingdom.

The stimuli which are effective in animal consciousness are four, viz: excessive temperature, hunger, danger from enemies, and the reproductive instinct. These prompt to the movements which we observe in animals in a wild state, and without which it is evident that the animals themselves would soon cease to exist.

It cannot be denied that organisms which are incapable of moving from place to place in search of food, or of migration to escape vicissitudes of temperature, are much more completely subject to the influences of their environment, than those that are capable of such movement. Hence animals are much more independent of the supply of food and of temperature than are plants. Hence also, other things being equal, the greater the powers of motion, the greater the independence.

Powers of movement then enable animals to avoid extremes of climate by migrations or by protective arts. They enable them to procure food by making journeys in search of it, and by all methods of capturing it. They furnish the agent of active defence against enemies, and of successfully reproducing their kind.

When, through changes of level of the earth's surface, drought has overtaken a region, animals capable of the necessary migrations have escaped. When an irruption of destructive animal enemies has threatened an animal population with death, those members of it whose strength or speed ensured them safety, were the survivors. When land has been encroached upon by water to such a degree as to bring starvation on its animal inhabitants, those which could fly or swim have sought new localities.

Since all food supply, as well as the ability to obtain food, is dependent on temperature, those portions of the organism which furnish means of resistence to climatic vicissitudes have the deepest significance in the life history of any division of animals.

The organs of circulation and motion are generally recognized as primary in the classification of *Vertebrata.* All situations where animal life is permitted by climate, support vegetable life also; so each of the primary divisions of animals presents types adapted to the use of all kinds of food; herbivorous, omnivorous, and carnivorous. Accordingly it has been found that dental and other structures connected with digestion, define divisions of secondary value and minor extent. Paleontology shows that the origin of such divisions is of later date than that of the great classes first mentioned; and each of the latter has in its day been modified in the subordinate directions indicated by the teeth and beak. But here also organs of movement are of great importance; so that the herbivorous and carnivorous types at least, have ever in land animals (reptiles, birds and mammals) been characterized by the structure of their feet also.

IV.

It has been maintained above, that environment governs the movements of animals, and that the movements of animals then alter their environment. It has also been maintained that the movements of animals have modified their structure so as to render them more or less independent of their environment. The history of animal life, is in fact that of a succession of conquests over the restraints imposed by physical surroundings. Man has attained to a wonderful degree of emancipation from the iron bonds that confine the lower organisms.

It becomes then all important to examine into the elements involved in animal movements.

These are of the two classes, reflex and conscious. To the former, belongs the accelerated activity of muscular action and circulation, inferred to have accompanied increase in the percentage of oxygen in the atmosphere, during the earlier periods of geological time. To the consciously performed acts belong all those due to states of pain or pleasure in animals; such as are excited by the four classes of stimuli already mentioned.

Doubtless physical changes in the surrounding medium have always produced new reflex movements in animals, and have been a first element in evolution. Such has been the immediate cause of change of structure in plants, and in animals so far as they are unconscious. But consciousness brings with it limitless possibilities, since it places an animal in contact with innumerable stimuli, which leave unconscious beings unaffected. All the causes which provoke the movements of higher animals are appeals to consciousness, and the consequences due to movements of such beings have only been possible through consciousness.

It is evident then that sensibility to impressions has been the prime essential to the acquisition of new movements, and hence of new structure, other things being equal. Another essential, not less important, has been memory; because without this faculty, experience, and hence education and the acquisition of habits of movement, are not possible.

The ascending development of the bodily structure in higher animals has thus been, in all probability, a concomitant of the evolution of mind, and the progress of the one has been dependent in an alternating way on the progress of the other. The development of mind has secured to animals the greatest degree of independence of their environment of which they are capable.

The first important acquisition leading to this end was aërial respiration; the second, rapid nutrition by hot blood. And as essential to the production and preservation of these, improvements in organs of movement have been superadded to every successive type of life.

Consciousness remains as the unresolvable factor in the process; as at once the measure of, and respondent to a large class of phenomena.

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RECENT LITERATURE.

Cook's Biology.[1]—It appears that the author of this book, after finishing his theological studies, exhausted the study of biology in the course of a summer's vacation by lying on his back on "Bioplast Beach," reading Beale on the Microscope and some of the popular books of Huxley and Haeckel on the Darwinian question. This may be an excellent way to get up a course of sensational lectures for an audience of clergymen and others who wish to be amused after their Sunday toil, but until we have some evidence that the author personally made the acquaintance of the weeds, snails, and other creatures living about this romantic Bioplast Beach, and spent a number of years studying their structure, development, and classification, we fear that the book must be set down as a burlesque on biology. The title, even, is misleading. The book should more properly be dubbed Romance of Natural Theology. No naturalist will want to waste time over it, and the lay as well as the clerical reader should look with no little suspicion upon the distorted science and sensational statements scattered through its pages. The Preludes are much better to our mind than the Biology.

Vaughan's Osteology and Myology of the Domestic Fowl.[2]—An account of the skeleton and muscles of the common fowl, such as this, will prove of much use to one beginning the study of anatomy. This book is well prepared and fully illustrated, and will be of service in the laboratory.

The Geological Record for 1875.[3]—This volume is of the same nature as the one issued last year, though it is larger, improved in its plan, and contains an index of new species, which will add to its value in the eye of the palæontologist. As the

[1] *Biology: with Preludes on Current Events.* By Joseph Cook. Boston: James R. Osgood & Co. 12mo, pp. 325.

[2] *Notes on the Osteology and Myology of the Domestic Fowl* (*Gallus domesticus*). By Victor C. Vaughan, Ph. D. Sheehan & Co., Ann Arbor, Mich. 1876. 12mo, pp. 116. $1.50.

[3] *The Geological Record for* 1875. An Account of Works on Geology, Mineralogy and Palæontology, published during the year. Edited by William Whitaker. London: Taylor and Francis. 1877. 8vo, pp. 443.

American literature in the departments of which it treats is given in the same careful, detailed way as the European, our mineralogists, geologists, and palæontologists will find in it the only annual digest of discoveries and of new works to be had in the language; and it is for their interest, perhaps, to patronize the undertaking of the editor. It is partly supported by a grant from the British Association, but still needs a larger list of subscribers for its maintenance.

WINCHELL'S RECONCILIATION OF SCIENCE AND RELIGION.[1]— While there may be an occasional antagonism between scientists and theologians, due mainly, perhaps, to mutual ignorance of each other's aims and to quite different methods of study, few will admit that science and religion are at variance, for one is based upon the other. Superstition is based on ignorance. The greater our advance in science the more will crude dogmas and superstitions be eliminated from our religious conceptions. Science is only another name for human knowledge. Morality and religion rest on a scientific foundation, namely, a thorough knowledge of the laws of health, of physiology, and of psychology. The truly scientific mind has above all things a reverence for truth, and pursues knowledge for its own sake, regardless of consequences to preconceived notions or dogmas. Such a spirit will in the end serve only to strengthen the foundations of a pure morality and a true religion.

The essays are by an expert in geology, and a theologian as well, and therefore the volume is an authoritative one on this absorbing theme.

JOHNSON'S CYCLOPÆDIA.[2]—The fourth volume of this compact and useful cyclopædia well compares with the three that have preceded it, and the work as it now stands, from a scientific point of view at least, is quite as fresh and timely as could be desired. While the literary and biographical articles are excellent, especial stress has, as may be imagined from the names of the editors, been given to physical and natural science. Most of the zoölogical articles in the present volume have been contributed by Prof. Theodore Gill, though a lengthy and well illustrated article on sponges is contributed by Prof. Hyatt. Botanical articles by Profs. Gray, Goodale and Farlow, geological articles by Prof. Newberry, and palæontological articles by Prof. O. C. Marsh, attest the freshness and accuracy of the contributions, and the judgment shown by the editors in selecting the leading specialists of the country as collaborators.

[1] *Reconciliation of Science and Religion.* By ALEXANDER WINCHELL, LL.D. New York: Harper & Brothers. 1877. 12mo, pp. 403.

[2] Johnson's New Universal Cyclopædia: a scientific and popular treasury of useful knowledge. Illustrated with Maps, Plans and Engravings. Editors-in-chief, F. A. P. Barnard and Arnold Guyot. Complete in 4 vols. Vol. IV., 1878. A. J. Johnson & Son, New York. 8° pp. 1760.

RECENT BOOKS AND PAMPHLETS.—The Geological Record for 1875. An Account of Works on Geology, Mineralogy, and Palæontology published during the year. Edited by William Whitaker. London: Taylor & Francis. 1877, 8vo., pp. 443.

The different Forms of Flowers on Plants of the same Species. By Charles Darwin. With Illustrations. New York, D. Appleton & Co. 12 mo., pp. 352.

Pollen. By M. Pakenham Edgeworth. Illustrated with 438 figures. London. Hardwicke and Bogue, 192 Piccadilly. 1877. 8vo, pp. 92.

Notes on the Structure of Several Forms of Land Planarians, with a Description of Two New Genera and Several New Species, and a List of all Species at present known. By H. N. Mosely. 8vo, pp. 21. (From Quarterly Journal of Microscopical Science.)

On Stylochus pelagicus, a New Species of Pelagic Planarian, with Notes on other Pelagic Species, on the Larval Forms of Thysanzoön, and of a Gymnosomatous Pteropod. By H. N. Mosely. 8vo, pp. 11. (From Quarterly Journal of Microscopical Science.)

Catalogus Plantarum in Nova Cæsarea Repertarum. Catalogue of Plants growing without Cultivation in the State of New Jersey, etc. By Oliver R. Willis. Revised and enlarged edition. A. S. Barnes & Co., New York, Chicago, and New Orleans. 8vo, pp. 88.

Practical Directions for Collecting, Preserving, Transporting, Preparing, and Mounting Diatoms. By Professors A. M. Edwards, Christopher Johnston, H. L. Smith. New York: The Industrial Publication Co. 1877. 12mo, pp. 53.

The Illinois State Historical Library and Natural History Museum. Circular No. 1, Springfield, Illinois. 8vo, pp. 7.

Das Variiren der grösse gefärbter Blüthenhüllen und seine Wirkung auf die Naturzüchtung der Blumen. Von Dr. Herman Müller. (From Kosmos.) 8vo, pp. 14.

Glacial or Ice Deposits in Boone County, Kentucky, of two Distinct and Widely Distant Periods. By George Sutton. (From the Proceedings of the American Association for the Advancement of Science, Buffalo Meeting of 1876.) 8vo, pp. 5.

The Latimer Collection of Antiquities from Porto Rico in the National Museum at Washington, D. C. By Otis T. Mason. (From the Smithsonian Report for 1876.) Washington. 1877. 8vo, pp. 23.

Science Lectures at South Kensington. The Steam Engine. By F. J. Bramwell. With Illustrations. London and New York: Macmillan & Co. 1877. 12mo, pp. 62. 25 cents. For sale by S. E. Cassino, Salem, Massachusetts.

A Review of the Birds of Connecticut, with Remarks on their Habits. By C. Hart Merriam. (From the Transactions of the Connecticut Academy, iv, 1877.) 8vo, pp. 165.

First Annual Report of Sapporo Agricultural College, 1877. Tokei. 8vo, pp. 146.

An Examination of Types of some Recently Described Crustacea. By T. Hale Streets, M. D., and J. S. Kingsley. (From the Bulletin of the Essex Institute, vol. six. No. 7, 8, 9.) Salem. 1877. 8vo, pp. 6.

Notice of a New Genus of Annelids from the Lower Silurian. By George Bird Grinnell. (From the American Journal of Science and Arts. September, 1877.) 8vo, pp. 2.

On the Cambari of Northern Indiana. By Will F. Bundy. (Proceedings of the Academy of Natural Sciences.) Philadelphia. 1877. 8vo, pp. 4.

Transactions of the Kansas Academy of Science. Vol. v. Topeka. 1877. 8vo, pp. 75.

Ferns of North America. By Daniel C. Eaton. Part 1. 1877. S. E. Cassino, Naturalists' Agency, Salem, Mass. 4°, pp. 12. 3 colored plates. $1.00.

A New Order of Extinct Reptilia (*Stegosauria*) from the Jurassic of the Rocky Mountains. By Prof. O. C. Marsh. (Appendix to the American Journal of Science and Arts. Dec., 1877. pp. 1.) New Haven.

Descriptive Catalogue of Photographs of North American Indians. By W. H. Jackson. Washington, 1877. Miscellaneous Publications, No. 9, of the U. S. Geological Survey of the Territories, F. V. Hayden in charge. Washington, D. C. 8°, pp. 124.

Paleontological Bulletin, No. 26. On some New or Little Known Reptiles and Fishes of the Cretaceous No. 3, of Kansas. By E. D. Cope. (Read before the American Philosophical Society, August 17, 1877.) 8°, pp. 20.

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GENERAL NOTES.

BOTANY.

NOTES ON THE ALPINE FLORA OF MT. SHASTA.—While looking for insects on the crater cone of Mt. Shasta, in Northern California, late in August, I hastily picked up examples of all the plants I could find at and above timber line, and at the lower edge of the limits of perpetual snow, which is said on this peak to be about 9000 feet above the sea. I was struck, though not a botanist, with the radical difference between the alpine (?) flora of Mt. Shasta and that of the Rocky Mountains and the White Mountains and the Alps of Switzerland. In the case of Mt. Shasta, which forms the northern terminus of the Sierra Nevada, the flora seemed much less alpine in its nature than was expected, and appeared to have been of local derivation from the foothills and plains below. I am indebted to Mr. Sereno Watson for naming the phænogams, to Prof. W. G. Farlow, for identifying the lichens, while Mr. Booth kindly named the Carex. No distinctive alpine insects occurred, only a wingless locust, which was also found lower down among the firs.—*A. S. Packard, Jr.*

Phænogams — *Silene grayi* Watson (ized.) (in flower); *Saxifraga tolmiei* T. & G. (in flower); *Applopappus bloomeri* Gray (in flower); *Senecio aureus* var. *borealis* (in flower); *Penstemon mensiesii* Hook (in flower); *Penstemon mensiesii* var. *douglasii* (in flower); *Elymus sitanion* Schult (in flower); *Polygonum shastense* Brewer (in flower); *Lupinus ornatus* Dougl. (in flower); *Bryanthus empitriformis* Gray; *Phlox douglasii* Hook. (in flower); *Erigonium morifolium* T. & G. (reduced form, in flower); *Erigonium pyrolæfolium* Hk. (in flower); *Ceanothus prostratus* Benth.; *Sedum glandulosum* Nutt; *Polymonium humile* Willd; *Gilia pungens* Benth. (in flower); *Hulsea nana* Gray (in flower); *Pinus albicaulis.*

Carex—breweri Booth.

Lichens—*Lecanora chlorophana, Lecanora rubina* var. *opaca? Lecanora glaucoma? Umbilicaria rugifera* Nyl.,

PRODUCTION OF APPLES IN "OFF" YEARS.—We have been informed by Mr. Elbridge Gerry, of Marblehead, Mass., that some twenty-five years ago the foreman of the Pickman Farm, in Salem, raised crops of apples in the "off" year, *i. e.*, the year they usually

did not bear, by simply picking off the fruit buds in the bearing years. His neighbors could never understand how he was enabled to raise a fair crop each year, until finally the secret became known. This mode of artificial selection is quite new to us, and we would like to know if it has ever been practiced before in orchards.

In connection with this subject I am told by Mr. John Sears, of Danvers, Mass., that in old orchards deep ploughing, by which the roots are often torn and broken, carried on in the "even" years, will cause the young apples to fall off, so that they will bear the next year. Also picking off the apples on the young trees in the "even" years will cause the trees to produce in the "off" years. Still, adds Mr. Sears, none of these processes are perfectly sure.—*A. S. Packard, Jr.*

Botanical News.—The following articles appear in the *Annales des Sciences Naturelles*, for September 1877. J. Vesque, on the absorption of water by roots in its relation to transpiration. Sorokine, On the structure of *Crocysporium torulosum* (a microscopic fungus). J. Wiesner, Researches in regard to the influence of light and radiant heat upon transpiration in plants. Dehéran, A notice of the preceding memoir. Van Tighem, On the digestion of albumen. Fischer de Waldheim, On *Ustilagineæ* and their hosts.

Flora, No. 23, contains the following papers: W. Nylander, Remarks concerning gonidia and their different forms; No. 24, A. Wigand, On horn-prosenchyma; No. 25, Hugo de Vries, Concerning longitudinal epinastic (elongation of the internal surface of an organ); F. Arnold, The Musci of the French Jura; No. 26, Dr. H. Christ, Roses observed in 1876, de Thümen, South African Fungi; No. 27, Schulzer, Concerning certain Fungi; No. 28, Robert Caspary, Life of Alexander Braun.

Botanische Zeitung, No. 39, Dr. O. Drude, Selected examples to explain the formation of fruit in *Palmeæ* (continued and illustrated by plates in No. 40); No. 40, Prof. J. Baranetsky, On diurnal periodicity in the growth of internodes in length; Oudemans, Notices respecting certain Boleti. Many critical notes by the editors conclude the number. No. 41, Rostafinski and Woronin, On *Botrydium granulatum* (continued in No. 42). No. 42, Dr. Karl Goebel, History of the development of the Prothallium of *Gymnogramme leptophylla*, Desv.

A Botanical Section of the Peabody Academy of Science, Salem, consisting of about twenty members living in Salem and adjoining towns, has lately been formed there, bi-monthly meetings having been held. Dr. G. A. Perkins is Chairman, and Miss L. H. Upton, Secretary.

The nature of the Spermatia is discussed by G. Murray, in Trimen's *Journal of Botany*, for October.

The Nuovo Giornale Botanico Italiano, for October, contains a paper by O. Beccari, describing a new genus of the family Olacineæ; and the editor, T. Caruel, proposes a new classification of plants, the reasons for which are to be given in an unpublished work on vegetable morphology. The transactions of the Royal Swedish Academy for 1874 and 1875 (just received in this country), contains papers by Heer, on the miocene flora of Greenland; by Berggren, on the mosses and Hepaticæ of Spitzbergen, and also on the mosses of Disco Island, Greenland.

ZOÖLOGY.

NOTE ON THE GARTER SNAKE.—While making some geological examinations on the bank of Lone Tree Creek in Colorado last summer, I started a common snake (*Eutænia*, sp.) upon the bank. It immediately took to the water, which was then about eighteen inches deep and had but little current, rested upon the surface and looked at me. I threw a stone which struck near it, when it immediately stretched itself upon the surface, gulped down into its lung a quantity of air, and immediately dived to the bottom and remained there. The mass of air it swallowed caused a distinct globular swelling of the body, which I saw pass along to the region occupied by the posterior end of the lung, where it remained, as I could distinctly see through the clear water, after it had reached the bottom. I then threw a broad, flat stone so that it fell upon the snake and held it fast, whereupon two or three large bubbles of air rose to the surface. I then lifted the stone from it with a stick, allowing it to escape, and as it did so I saw that the air-swelling had disappeared.

I infer that this is probably a habit with the snakes under such circumstances, but I was not aware of it before. In this case the air seems to have been intentionally passed back to the posterior, simple sac-like portion of the lung, where respiratory capillaries are few, to be passed forward to the more cellular anterior portion when the respiratory needs might require it.

The cellular character of the anterior portion of the lung would seem to have offered some impediment to the rapid swallowing of so much air, but I am sure it was so done in this case.—C. A. WHITE, M. D.

NESTING OF THE ROBIN ON THE GROUND.—An instance of this deviation from the usual conditions of nest-building came to my knowledge in May, 1875, near Vineland, New Jersey, where I found a nest of *Turdus migratorius* on the ground. It contained four eggs, and was not peculiar in structure. The nest was identified, as one of the old birds flew from it on my approach. I also saw a stump about a foot and a half high, on which I was informed that a pair of robins had nested.—H. W. TURNER, Ithaca, New York.

WILD GEESE NESTING IN TREES.—While in Greeley, Colorado, last summer, Mr. Louis Wyatt told me that he had seen wild geese nesting in large cottonwood trees on Snake River, a branch of the Yampah or Bear River, west of the Rocky Mountain range, in Colorado, at a point bearing a little north of west of Greeley, Colorado. This is the only instance published, I believe, of this habit as observed in Colorado. Dr. Coues, in his "Birds of the Northwest," states that it "nests in various parts of the Upper Missouri and Yellowstone regions *in trees*."—*A. S. Packard, Jr.*

RATE OF GROWTH OF THE BARNACLE.—Upon taking up, Nov. 17, a post to which my boat was moored, and which was put down at low-water mark April 5th, 1877, in Salem harbor, I found numerous barnacles (*Balanus balanoides*) living and of nearly full size, being four-tenths of an inch in diameter and about two-tenths high. With them were small *Fucus vesiculosus*, the largest one of which was about three inches in length. The post was a new one and had not been used the year previous. A number of similar observations will be found in Darwin's work on barnacles.—*A. S. Packard, Jr.*

ANTHROPOLOGY.

THE ARCHÆOLOGY OF THE PACIFIC COAST.—The Rev. Stephen Bowers has just completed an archæological exploration along the Pacific Slope for Major J. W. Powell, who is in charge of the Survey of the Rocky Mountain Region. During the six months of his labors, Mr. Bowers examined one hundred and fifty miles of the southern coast of California, and the inland country drained by the three streams, Santa Iñez River, Sisquoc River, and Cuyama River. He also visited San Miguel and Santa Cruz Islands, having previously explored Santa Rosa Island for the Smithsonian Institution. The results of his last and most important expedition are between five and six tons of antiquities.

The collections obtained consist of the following objects: Ollas of crystalized talc; *tortilla* or millstones of the same material; arrow-smoothers of the same material; mortars and pestles of sandstone (some of the latter finely wrought and over two feet in length); cups of serpentine; pipes of indurated talc and other material; charms or amulets of talc, etc.; perforated discs of serpentine, sandstone, etc.; spear-points and arrow-heads; knives of chert; vast quantities of shell ornaments, and beads, in great variety; stone tubes, etc.

The perforated discs or "stone rings or doughnuts" Mr. Paul Schumacher believed to have been employed to give weight to the wooden spades with which the ancient pits or graves were dug. This attempt to designate their use is as clever as his inference is improbable. The rings are usually so light in weight as to be of no value in this respect, and in order to be serviceable as weights they would be too bulky for use. They weigh from a few ounces

to several pounds. A more plausible explanation of their use is the one Mr. Bowers advances: he says, "Those of pyramidal form were doubtless used in spinning, while others were used in games." —E. A. Barber.

Anthropological News.—It has been impossible to obtain a programme of the German Scientific Association, but reports of two very interesting communications have reached us. Professor Haeckel's address on the evolution theory of the present day in its relation to science in general was an earnest reiteration of his theory of inheritance and adaptation, applying it to moral and mental phenomena. Professor Virchow read a paper On the Liberty of Science in Modern Thought. He congratulated his fellow workers that science had now obtained perfect liberty, and at the same time warned them not to lose their influence by misusing it. He advocated the introduction of scientific instruction into the schools, but thought that great care should be used to introduce the results of science, and not mere unsubstantial theories such as the genealogical system of Professor Haeckel.

The second international congress of Américanistes was held at Luxemburg, September 10th–13th. Papers on the mound builders and Pueblos were read by Messrs Barber, Robertson, Gillman, Peet, and Force; on the antiquities of Greenland and the primitive habitat of the Eskimo by Messrs. Waldemar Schmidt and Rink; on hieroglyphics and ancient culture, by Leon de Rosny, Hyde Clarke, Maladier de Montjau, Allen Schwab, Malte-Brun, Ttronck, Abbé Pipart, Dr. Leemans, etc.; on philology, by Messrs. Henry, Moore and Lucien Adams; on history, by Messrs. Brauvoisn and Nadal; on the stone age, by M. Guimet. The next congress will be held in Brussels in 1879.

Occasionally papers of great value to anthropologists appear in journals not wholly devoted to their science. Among these *La Révue Scientifique* is to be specially mentioned. In the number for January 13, 1877, M. Jouan writes upon Les Monuments polynesiens; in that for February 3d, M. Quatrefages has a long paper reviewing that portion of his late work, L'Espèce humaine, which refers to fossil man. The whole work in favorably noticed in the number for March 4th, by M. W. Ferrier. In the numbers for May 5th and 12th, Carl Vogt discusses at length the origin of man. The learned author takes issue with both Haeckel and Quatrefages, and, while advocating evolution, maintains that the former has erred quite as far in knowing too much as the latter has in his "Je ne sais pas rien." The same periodical for September contains quite full reports of the French Association.

Two fields of anthropological research are so fully occupied at the present time that one almost despairs of keeping the run of titles even. We refer to the seat of war and British India. Happily the latter field is well worked in Trübner's last catalogue, to which all must refer who would become familiar with the subject. The work of D. Mackensie Wallace on Russia, of W. R. London

on Savage and Civilized Russia, and of Russell on Russian Wars with Turkey cannot be omitted from the list of those who wish to read up on the seat of war.

The Tenth Report of the Peabody Museum is one of the most interesting in the series. We have already referred to Dr. Abbott's paper. Those of Professor Andrews and Admiral F. Bandelier are worthy of careful study.

Two articles have appeared in the New York *Nation* concerning the Nes Percés in the numbers for July 12th and August 2d. The same journal, September 6th, treats of the Indian policy of Canada and of the United States.

The archæological section of the Academy of Sciences at St. Louis, has published a caution to collectors against imitations of pottery, etc., from the mounds. The same difficulty has arisen in England and Germany with reference to antiquities within their own borders and from the East: notably, Flint Jack, the Shapira collection of Moabite pottery, and the carvings from the Thurigen Cave, near Schaffhausen in Switzerland. Colonel Whittlesey has done good service in exposing frauds in hieroglyphics, and Mr. J. D. Moody of Mendola, Illinois, sends a pamphlet of four pages, attacking the authenticity of the Rockford Tablet. No one should be more zealous than the archæologists themselves in unearthing everything of the kind, since no amount of doubtful material will aid the truth in the least.—O. T. Mason, Washington, D. C.

GEOLOGY AND PALÆONTOLOGY.

The Saurians of the Dakota Epoch.—Professor Cope has recently described two additional species of terrestrial saurians from the Dakota rocks of Colorado, which rival the *Camarasaurus supremus* in dimensions. They are referred to a new genus which resembles *Camarasaurus* in the chambered character of the vertebral centra, and in the peculiar interlocking articulation of the neural arches, but differ from it in the amphicœlous character of the centra and the form of the neural spine, which is longitudinal instead of transverse. The articulation of the neural arches alluded to is very peculiar, and is effected by the presence of a new vertebral element which Professor Cope calls a hyposphen. It is an inverted wedge which is attached to the posterior zygapophyses below them by a median vertical plate of bone. This plate enters a deep fissure between the anterior zygapophyses and it results that the latter are tightly embraced between the posterior zygapophyses above, and the hyposphen below. This structure is the reverse of that of the zygosphen articulation.

The new genus is called *Amphicœlias*, and the species *A. altus* and *A. latus*. The length of the femur of the former is six feet two inches, a little exceeding that of the *Camarasaurus supremus*, but it is more slender. The elevation of a dorsal vertebra is three feet two inches. The *A. latus* is characterized by robustness, as the *A. altus* is by elongation of parts. A caudal vertebral cen-

trum is ten inches in transverse diameter; with others it is more depressed and more deeply bi-concave than the corresponding vertebra of *C. supremus*. The femur of this species is very thick, its length is fifty inches and the diameter fourteen inches.

Additional remains of *Camarasaurus supremus* include a femur six feet, and a scapula five and a half feet in length. The posterior dorsal vertebræ exceed in dimensions those of any known saurian, equaling those of the right whale. The centra measure sixteen inches in transverse diameter.

Mount Lebanon Fishes in Dakota.—Many years ago Dr. Hayden obtained some fossil fishes from the Cretaceous No. 3 of Dakota. They have been recently examined by Professor Cope, who describes them in the late number of the Bulletin of the United States Geological Survey of the Territories. He refers them to the genera *Triænaspis* g. n., *Leptotrachelus* Mark, *Ichthyotringa* g. n., *Spaniodon* Pict., and *Sardinius* Mark. The first, second and third genera belong to the *Dercetidæ*, and *Leptotrachelus* has been found in Syria and Westphalia. *Ichthyotringa* is allied to *Dercetis* of Westphalia, and *Triænaspis* to *Pelagorhynchus* of the same region. *Spaniodon* is a well-known Lebanon type and *Sardinius* is abundant in Westphalia. This determination adds evidence to that already in our possession, showing the wide distribution of types in the Northern Hemisphere during past time.

Cretaceous Fishes of England.—E. Tully Newton of the British Geological Survey, has recently discovered the Kansas genera *Portheus* and *Ichthyodectes* in the chalk of Kent, and finds several species of both.

Clepsydrops in Texas. — Professor Cope has recently obtained this genus from the so-called Triassic formation of Texas. This discovery confirms the reference of the *Clepsydrops* shales of Illinois to that formation or the Permian, in opposition to the view at first maintained by Professor Bradley that they are a member of the coal measures.

The Genus Tetraconodon.—Dr. R. Lydekker has recently described the dentition of this genus, which was discovered by Falconer in the Sivalik formation of India. He regards it as a bunodont Artiodactyle allied in some degree to *Hippopotamus*. He finds it to be very peculiar in that the premolar teeth are of relatively enormous size, although simple in their form. The characters of the genus resemble those of *Elotherium*.

The Affinities of the Dinosauria.—Professor Owen recently described an interesting Dinosaurian under the name of *Omosaurus armatus*. At the close of the article he makes some remarks on the structural relationships of the order. He thinks that the pubic bone is directed forwards, not backwards, as asserted by Huxley. The bird-like structure of the tibio-tarsal articulation,

first pointed out by Cope, he attempts to explain in another way. He regards the supposed astragalus of *Lælaps* and *Pœcilopleuron* as homologous with the tibial epiphysis of *Mammalia*, rather than with the astragalus, and he homologizes the distal tarsal element of *Dinosauria* with the mammalian diaphysis rather than with the second tarsal series.

Professor Owen has recently described an English species of *Lælaps* under the name of *Pœcilopleuron minor*.

Triassic Saurians from Pennsylvania.—Additional material received from Charles M. Wheatley, of Phœnixville, embraces some species of extinct reptiles from the Trias of Pennsylvania not included in the last report. (See Proceedings of the American Philosophical Society, 1877, p. 182.). These are of especial interest as introducing to American palæontological science two genera only known heretofore from the European Trias, viz: *Thecodontosaurus* and *Palæosaurus* of Riley and Stuchbury. These are called *T. gibbidens* and *P. fraserianus*. A third new species belongs to the genus *Suchoprion*, and is described as *S. sulcidens*. Mr. Wheatley has also obtained additional specimens of *Suchoprion cyphodon*, *Belodon priscus*, *Palæoctonus appalachianus*, and *Clepsysaurus wheatleianus*. Teeth of the last-named saurian indicate a larger animal than the type, and nearly equal to the *Palæoctonus appalachianus*.

New Artiodactyles of the Upper Tertiary.—Three new genera allied to *Oreodon* have recently been discovered in the Loup Fork beds of Montana, and been described by Professor Cope under the names of *Pithecistes*, *Brachymeryx* and *Cyclopidius*. All three are selenodont, have the mandibular symphysis coössified, and a deficiency in the number of the incisor teeth. In the first two genera there are only three premolars. In *Pithecistes* the inferior canine is functionally developed, there are but one or two incisors on each side, and the anterior premolars are broader than long. In *Brachymeryx* the premolars are trenchant except the last superior, which has four columns. The first inferior, is functionally the canine. *Cyclopidius* is similar to *Leptauchenia* in its dentition, excepting in the presence of only two inferior incisors on each side. The frontal region is occupied by enormous vacuities, two of which extend between the orbits, and are separated by the very narrow nasal bones, which, in the type species *C. simus*, do not extend beyond the lachrymal fossæ. The superior facial region is excavated, and the cavity is reached from the sides by a huge foramen in the facial plate of the maxillary bone. A second species, *C. heterodon* is described. The species of the other genera are *P. brevifacies* and *B. feliceps*.

Accompanying these was found a species of *Blastomeryx* (Cope) as large as the black-tailed deer, which is called *B. borealis*. The genus *Blastomeryx* is believed by Professor Cope to be the ancestor of the existing *Cervidæ*, as *Dicrocerus* is of *Antilocapra*.

GEOGRAPHY AND TRAVELS.

NARRATIVE OF HALL'S NORTH POLAR EXPEDITION.[1]—Captain Hall having died on his return to the winter quarters of the Polaris, from his journey to the farthest point north hitherto attained, it was reserved for others to write the record of his daring and successful expedition. The volume contains everything of general interest relating to the origination, organization and the fitting up of the expedition, which was first suggested and organized by Hall himself. One chapter is devoted to an account of Hall's earlier researches and is accompanied by a map illustrating the route he pursued during his eight years of Arctic exploration, which fitted him so well for the crowning work of his life. Geographers will also find in this volume a detailed account (sometimes too irrelevant details are given) of the eventful history of the expedition after Hall's death. The woodcuts are numerous, but are not of a high order of excellence.

STANLEY'S ACCOUNT OF THE CONGO.—Mr. Stanley thus sums up in his letter to the New York *Herald* and the London *Telegraph*, our present knowledge of the Congo River: The entire area the Congo drains embraces about 860,000 square miles. Its source is in that high plateau south of Lake Tanganyika, in a country called Bisa, or Ubisa by the Arabs. The principal tributary feeding Bemba Lake is the Chambezi, a broad, deep river, whose extreme sources must be placed about longitude 33° east. Bemba Lake, called Bangweolo by Livingstone, its discoverer, is a large body of shallow water, about 8,400 square miles in extent. It is the residuum of an enormous lake that in very ancient times must have occupied an area of 500,000 square miles, until by some great convulsion the western maritime mountain chain was riven asunder, and the Congo began to roar through the fracture. Issuing from Bemba Lake, the Congo is known under the name of Luapula, which, after a course of nearly 200 miles, empties into Lake Mweru, a body of water occupying an area of about 1,800 square miles. Falling from Mweru, it receives the name of Lualaba, from the natives of Rua. In Northern Rua it receives an important affluent called the Kàmalondo. Flowing in a direction north by west, it sweeps, with a breadth of about 1400 yards, by Nyangwe Manyema, in latitude 26° 15′ 45″ south, longitude 26° 5′ east, and has an altitude of about 1,450 feet above the ocean. Livingstone, having lost two weeks in his dates, appears, according to Stanford's map of 1874, to have placed Nyangwe in latitude 4° 1′ south, longitude 24° 16′ east, but this wide difference may be due to the carelessness of the draughtsman. Those who feel interested in it should compare it with the latest map

[1] Narrative of the North Polar Expedition, U. S. Ship Polaris, Capt. C. F. Hall, commanding. Edited under the direction of the Hon. G. M. Robeson, Secretary of the Navy, by Rear-Admiral C. H. Davis, U. S. N. U. S. Naval Observatory, 1876. 8° pp., 696.

issued by Stanford, or the map published with the traveler's last journals. The distance the Congo has flowed from its extreme source in Eastern Bisa to Nyangwe Manyema is about 1,100 miles.

EXPLORATIONS IN PALESTINE.—The Palestine Exploration Society, which is supported by voluntary contributions, was organized in 1870 for the purpose of making a scientific survey of the region known in Biblical history as Moab, Gilead and Bashan. In 1873 the first surveying party was sent out, and in 1875 the work of exploration was further extended by a second party, one of the members of which was Dr. Selah Merrill, who gave special attention to the archæology of the regions explored. The work of surveying was soon suspended, however, but Dr. Merrill continued his researches during 1876 and a part of the present year.

At a late meeting of the Society, as reported in the *Tribune*, Dr. Merrill said, in part: "One of the difficulties of exploration in Palestine is caused by the traditions which widely prevail—a difficulty which is experienced in exploration in no other part of the world. Numerous archæological facts have been collected, however, which will be very valuable in the study of the Bible. All explorations are carried on in the face of many obstacles. The climate is very peculiar and severe, and many explorers have lost their lives on this account. The Valley of the Jordan from Lake Tiberias to the Dead Sea, sixty miles in length and about three miles in width, is generally supposed to be a desert, but this is not so. I have examined the Valley of the Jordan on the east side several times, and I am satisfied that it could be easily irrigated from the Jordan itself. It would then become exceedingly fertile, and it is believed that half a million people could live in this valley. Some very important mounds exist in various parts of this region. In the Succoth region there is a very large one, thickly covered with pottery. Into this I wished to dig, for I think some very valuable results may be obtained in this way. It was in this region that King Solomon's brass foundries were situated. I think that the best evidence of the situation of the Cities of the Plain shows that they were at the north end of the Dead Sea. In the region east of the Jordan nearly all the houses are deserted, on account of the Moslem and Turkish rule. You can scarcely travel half an hour in this region without meeting with a valuable ruin. The theatres in many cases were built so as to command fine views of the surrounding country. Between Petra and Damascus there were between 400 and 500 miles of Roman roads. There was also in ancient times an extensive system of irrigation. This was especially apparent in the Valley of the Jabbok, the most fertile portions of which are now under cultivation."

ORTON'S EXPLORATIONS IN SOUTH AMERICA.—Several letters from the late Professor Orton have appeared in the New York

Tribune regarding his explorations in Peru, containing some interesting reflections on the probable number of inhabitants of Peru, at the time of their conquest by Pizarro. He thinks their numbers have been greatly overestimated by historical writers. Good collections of birds, reptiles and fishes were made, which by prearrangement are the property of Professor E. D. Cope.

GEOGRAPHICAL NEWS.—The *Geographical Magazine*, for November, contains a continuation of an interesting description of the island of Formosa, by James Morrison.——Professor Nordienskiöld expects to lead another Swedish Arctic Expedition, to start from Gothenburg about the 1st July, 1878, and *via* Tromsö or Hammerfest, make progress from Novaya Zemlya eastward, trying to force a passage along the coast of Siberia, and returning home through Behring Straits, and by the Suez Canal, thus sailing round Asia and Europe.——Next year the Norwegian Deep Sea Sounding Expedition will examine the region between North Cape, Jan Mayen, and the north of Spitzbergen, and possibly make a trip eastward, in the direction of Novaya Zemlya, to determine the position of the isothermal line of 0° C. at the sea-bottom, this line being considered the limit of the range of codfish.——Count Wilzek and Lieutenant Weyprecht have published a programme of work for the proposed international polar expeditions.——Capt. H. W. Howgate has published an account of the American preliminary Arctic Expedition, now wintering at the head of Cumberland Gulf. ——M. Kelsief has been making researches during the past summer along the Murmanian Coast and in Lapland, for the Moscow Anthropological Exhibition of 1879; he has made a good collection of stone implements and other prehistoric remains.——The geography of the Upper Indus has been made by a Punjab surveyor, who has completed our knowledge of this river.——Savorgnan de Brazza has arrived at Doume, in the Loando country, on his way eastward to the Ponbara Falls. The River Sibumbay, which some geographers have described as a northern affluent of the Congo, turns out to be a feeder of the Ogowai on its left bank.—— An expedition has left Belgium for the exploration of Central Africa. Dr. Maes, of Hasselt, accompanies the expedition as surgeon and naturalist.——Prof. E. S. Morse has returned from Japan after six months explorations in the neighborhood of Tokio, and has made several expeditions into the interior and about the coast, and discovered some prehistoric pottery, etc., of much interest.——Dr. Petermann has published a map of Costa Rica showing the results of Professor Gabb's survey made in 1873-4.

The Proceedings of the Royal Geographical Society, Nos. 4–6, have the following table of contents: No. IV.—Young, On a Recent Sojourn at Lake Nyassa, Central Africa. Mullens, A New Route and New Mode of Traveling into Central Africa. Buchanan, On the Distribution of Salt in the Ocean as indicated by the Specific Gravity of its Waters. Allen, Notes of a Journey through

Formosa from Tamsui to Faiwamfu. Bullock, Trip into the interior of Formosa. Nares, On the Navigation of Smith's Sound, as a Route to the Polar Sea. Carpenter, Lecture on the Temperature of the Deep Sea Bottom and the Conditions by which it is determined. Trotter, The Pundit's Journey from Leh to Lhása and return to India via Assam. Macfarlane, Voyage of the Ellangowam to China Straits, New Guinea. No. V.—Address at the Anniversary Meeting, May 28th, by Sir R. Alcock. No. VI.—Crowther, Notes on the River Niger. Hutchinson, Progress of the Victoria Nyanza Expedition of the Church Missionary Society. Wallace, Lecture on the Comparative Antiquity of Continents as indicated by the Distribution of Living and Extinct Animals. Markham, The Arctic Expedition of 1875–76 (with a map). Simson, Notes of Journeys in the Interior of South America. Smith, The Translation and Transliteration of Chinese Geographical Names. Marsh, Description of a Journey Overland to India, *via* Meshed, Herat, Candahar, and the Bolan Pass, 1872. Kirk, Visit to the Mungao District, near Cape Delgado. Cottam, Overland Route to China, *via* Assam, &c., across the Irrawaddi into Yunan.

Among recent geographical works are the following: S. W. Silver & Co.'s Handbook to the Transvaal; British South Africa, Its Natural Features, Industries, Population and Gold Fields, 1877. South Africa; Its Difficulties and Present State, suggested by a recent visit to that country. By A. R. Campbell Johnson, 1877. South Africa; Past and Present. By John Noble. Loango und die Loankuste. Von Dr. Pechuel-Lösche. Leipzic, 1876. (London, Trübner & Co.)

MICROSCOPY.[1]

New Cabinet for Slides.—Two slide cabinets have recently been described in *Science Gossip*, which possess some advantages for certain purposes, and have the no small recommendation that they can be easily and cheaply made.

Mr. T. H. Moorhead's cabinet is in the book form, and is made of card-boards mounted in slate frames. Common school slates are selected, of suitable size and with perfect frames. The frames are carefully smoothed at the corners, stained mahogany color if desired, and varnished and polished. The slates are then removed from them and replaced by card-boards cut to the same size and covered on both sides with fine white paper. Across the cards are stitched bands of silk elastic at such distances that when the card is covered with rows of slides nearly touching each other each row will be crossed and kept down by one band about an inch from the ends of the slides. The band is stitched to the card at intervals of an inch and a quarter, so that each slide will be separately held. Stout canvas can be tacked to the edge of each frame. and the whole bound together, in volumes of about five each, by a

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

bookbinder, forming a really handsome set. If the cards are six and a half by ten inches they will hold fifteen slides on a page. The slides and their labels are well displayed, though they cannot lie in the best position for safe keeping except by allowing the volume to lie flat and leaving the under page of each unused.

Mr. A. W. Stokes, of Guy's hospital, has contrived a slide box, which is less showy than this, but more compact and portable. As a compromise between a stationary cabinet and a box for carrying around, it seems to possess advantages not before attained. A box is made like an ordinary tray-slide box, opening both at the top and front. In this the slides lie flat in several tiers of a single row each, with their ends pointing towards the front of the box. The upper row rests in a tray with a ledge in front, and close to the cover when the box is closed. Below this the rows of slides rest on shelves, each of which projects forward half an inch or more beyond the one above it, so that the slides will also project and the labels of all the rows be visible at once. Stops are arranged between the shelves, behind, to prevent the slides slipping back too far, and between the separate slides on each shelf to prevent their striking together. A piece of card-board or thin wood hinged to the cover falls in a slanting direction across the rows, and keeps the slides from slipping forward in any position of the box when it is closed. The shelves may be of light card-board, as they are well supported by the wooden strips which confine the slides behind and at the sides. A box nine inches long by five inches broad and two inches deep will hold thirty-five slides in five rows or tiers of seven each. [A very neat case may be made of a good cigar box, while another box may be cut up to furnish the ledges or partitions between shelves.]

Diatoms.—Under this title the Industrial Publication Company has produced a neat and useful little book which will be a great convenience to many workers. It is a reprint of three papers on the subject of collecting, preserving, and preparing diatoms, by Professors A. M. Edwards, Christopher Johnston and M. L. Smith, respectively. These excellent papers will be handy in this form even for those whose libraries include the originals in the Lens and the Natural History of New Hampshire.

American Journal of Microscopy.—The great success of this popular journal of microscopy, together with the inconvenience of mailing half-dollars in the present state of our currency, has induced the radical change of doubling its size with a corresponding increase of price. While much better opportunity will thus be obtained for elaborate articles, the simple and elementary character will still be maintained. The change will please many readers and incommode but few.

Microscopical Societies.—The following elections of new officers have taken place since the last list published:—

American Association for the advancement of Science, microscopical subsection, meets annually in connection with the migratory sessions of the association. Chairman for the Nashville meeting, 1877, Dr. R. H. Ward, of Troy, New York; for the St. Louis meeting, 1878, Dr. Geo. S. Blackie, of Nashville, Tenn.

Dunkirk Microscopical Society. President, Geo. E. Blackham, M.D.; secretary and treasurer, A. P. Alling, M.D.

Fairmount Microscopical Society. President, S. H. Griffith, M.D.; secretary and treasurer, Wm. C. Stevenson, Jr.; managers, John Gordon Gray, Thomas D. Ingram, M.D., and Henry Winter Davis.

Nature Club, Albany, New York. Organized October 1877. Microscopy a prominent feature. Meets at residences of members on the second and fourth Monday evenings of each month. President, Geo. T. Stevens, M.D.; vice-president, D. J. Pratt; secretary, Richard Prescott.

State Microscopical Society of Illinois. President, Henry W. Fuller; vice-presidents, Lester Curtis, M.D., and Chas. S. Fellows; secretary, H. F. Atwood; corresponding secretary, O. C. Oliver, M.D.; treasurer, B. W. Thomas; trustees, S. J. Jones, M.D., Professor E. Bastin, W. H. Summers, H. M. Thompson and James Colgrove.

Troy Scientific Association; microscopical section. Chairman, R. H. Ward, M.D.; vice-chairman, Rev. A. B. Hervey; secretary, Professor A. W. Bower.

Tyndall Association; section of microscopy. President, Rev. I. F. Stidham; secretary and treasurer, Curtis C. Howard; curator, Professor T. C. Mendenhall.

EXCHANGES.—A Curtis' section cutter, made by Miller, of New York (cost $20.00), for microscopical objects or books. Address offers to C. E. H., No. 1 Gale Place, Troy, N. Y.

Plumule scales of small cabbage butterfly (*Pieris rapæ*), mounted, for good slides. Address Edward Pennock, 805 Franklin street, Philadelphia.

Very fine mountings of shells from the Bermudas, for objects of special interest. Address C. C. Merriman, Rochester, N. Y.

Material: Marine algæ, diatoms in situ on algæ from east and west coasts, musci, lichens, ferns, lycopodia, garnet sand, &c., in exchange for mounted slides. M. A. Booth, Longmeadow, Mass.

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SCIENTIFIC NEWS.

— Two articles on the evolution of nerves and nerve-systems, illustrated by the structure of *Aurelia*, a type of the lowest group of animals in which a nervous system appears, have been pub-

lished by G. J. Romanes, in *Nature*, for July 26th, and August 2d. By removing the eight nervous ganglia, the whole disc of the jelly-fish presents not merely the protoplasmic qualities of excitability and contractility, but also the essentially nervous quality of conducting stimuli to a distance irrespective of the passage of a contractile wave. He therefore concludes that there can be no longer any question that we have here to deal with a tissue already so far differentiated from primitive protoplasm, that the distinguishing function of nerve has become fully established.

— Dr. Sachs, who was sent to Venezuela by the Berlin Academy of Science, for the purpose of studying the electric eel in its native haunts, has returned, says *Nature*, after an absence of ten months, with a rich store of valuable observations.—A second specimen of *Archæopteryx lithographica* has been discovered near Solenhofen; this specimen is much more perfect than the other, and possesses the entire head.—The bones of the skull of *Amia calva* have been described in detail by T. W. Bridge, in the English *Journal of Anatomy and Physiology*.

— Professor E. D. Cope has lately visited the Nickajack Cave near Chattanooga in Company with Professors Loverell and Nipher, Dr. Walker and Mr. Lindsley. The cave is as large as the Mammoth or Wyandotte caves, and is traversed by a large stream. He found an abundance of a blind craw-fish and several small crustacea, some of them allied to Cæcidotæa. He also procured the myripod, *Spirostrephon cavernarum*, a spider with eyes, and a Raphidophora, etc.

— We have received some advance sheets of Erklärungen zu den Zoologischen Wandtafeln, herausgegeben von R. Leuckart, professor in Leipzig, and Dr. H. Nitsche, professor in Tharand. Taf. i.–iii. Cassel, Theodor Fischer, 1877. These are colored diagrams, printed from stone, and are well selected and in all respects admirable. They are designed for the use of schools and colleges, and the series will, when finished, comprise about one hundred sheets, accompanied by an explanation of each plate in German, French and English. The price to subscribers for the whole work will be from eighty pfennigs to two marks (a mark is 32 cents). It will be seen by this that the diagrams as a whole will be quite cheap.

— The death of Professor James Orton, occurred about the 24th of October last, while he was crossing Lake Titicaca, *en route* for Puno. He had been some time in Bolivia, and having relinquished his journey to the Beni River, was on his way home. Professor James Orton was bora at Seneca Falls, N. Y., April 21, 1830. He was graduated at Williams College in 1855, and in 1858 at the Andover Theological Seminary. After traveling in Europe and in the East, he was ordained a congregational minister in 1860. In 1866 he became instructor in the natural sciences at Rochester University. The year following he went at

the head of an expedition from Williams College to South America. On this occasion he crossed the continent by Quito, the Napo and the Amazon, discovering the first fossils found in the Amazon valley. In 1869 he became Professor of Natural History at Vassar College. In 1873 Professor Orton made a second journey across South America, from Para up the Amazon to Lima and Lake Titicaca. About a year ago Professor Orton returned once more to South America, to undertake alone and with limited means, the exploration of the Great Beni River, which carries the waters of Eastern Bolivia to the Amazon, by way of the Madeira. His works are: "The Miner's Guide and Metallurgists' Directory" (1849); "The Proverbalist and Poet" (1852); The Andes and the Amazon" (1870); "Underground Treasures; How and Where to Find Them" (1872); and "Comparative Zoology" (1875).

— Messrs. S. H. Scudder, of Cambridge, and F. C. Bowditch, of Boston, have just returned from a two months' tour in Colorado, Wyoming and Utah, where, under the direction of Dr. Hayden, they have been exploring for fossil insects, and collecting specimens especially in the high regions. They report having secured many specimens of fossil insects at different points along the railways from Pueblo to Cheyenne, and from Cheyenne to Salt Lake, as well as at Lakin, Kansas, and Garland, and Georgetown, Col., and in various parts of the South Park and surrounding region. Ten days were spent at Green River, and in that vicinity, in exploring the tertiary strata for fossil insects, but with very unsatisfactory results. Near Florisant, the tertiary basin was found to be exceedingly rich in insects and plants. Mr. Scudder spent several days in the careful survey of this basin, and estimates that the extent of the insect-bearing shales there is at least fifty times as great as that of those in Southern Bavaria. Six or seven thousand specimens of insects, and 2,000 or 3,000 of plants have already been received from Florisant, and as many more are expected before the close of the year. Arrangements were also made with persons who have found a new and rich deposit of fossils in the tertiary strata in Wyoming, to forward all the specimens obtained there.

Mr. Scudder believes that the tertiary strata of the Rocky Mountain region are richer in the remains of fossil insects than any others in the world, and that within the next few months the amount of material at hand for the study of the subject, will be greater than was ever before possessed by any single naturalist.

— Professor Joseph Leidy, the comparative anatomist and microscopist, has also recently returned from his second visit to the West, under the direction of Dr. Hayden. His field of operations during the past season, was the country about Fort Bridger, Unitah Mountains and the Salt Lake Basin. The specimens he has collected comprise the lowest and simplest forms of animal life,

the most minute requiring high microscopic power to distinguish their structure.

— Captain Howgate has received a letter via Scotland, from Captain Tyson, who commands the *Florence*, the advance vessel of the American Arctic Expedition. It is dated September 29, and reports Captain Tyson's safe arrival at Niuntilick Harbor, Cumberland Gulf, after a tedious voyage of forty days. He proposes moving to the head of the gulf in a few days, to go into winter quarters, and carry out his instructions in reference to the collection of material. The crew were all in good health and spirits. Messrs. Sherman and Kumlein are reported as doing well in their respective departments.

— We regret to learn that the note on page 749, volume xi, has been regarded by Dr. Brewer as too personal, and construed as an affront. The writer begs us to disclaim for him the slightest intention of reflecting upon Dr. Brewer's veracity and sincerity in his conduct of the sparrow controversy. The bantering sentence seemed to bear its own credentials; but since it has been misconstrued, the writer permits us to substitute the following: "Dr. Thomas M. Brewer, has so long remained in what I consider to be his honest misapprehension of the real bearing of alleged facts, in the face of testimony no less explicit, that it is no longer a question with me whether he will continue to argue as heretofore against such bearing of the testimony.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

National Academy of Science.—At the session held in New York, October 23d to 25th, the following papers on subjects relating to natural science were read: On the Development of Flounders, by A. Agassiz. On the Morphology of the Antlers of the Cervidæ, by Theodore Gill. On some new Fossil Fishes from Ohio and Indiana; on the Geological Age of the Western Lignites, by J. S. Newberry. On some Gigantic Dinosaurian Reptiles from the Wealden of the Rocky Mountains; American Cretaceous Birds, by O. C. Marsh. On the Air-Sacs of Locusts, by A. S. Packard, Jr. On the Glycogenic Functions of the Liver, and its relation to Vital Force and Vital Heat, by Joseph LeConte. Biographical Memoir of Louis Agassiz. First part, relating to his Life and Work in Europe, by A. Guyot.

Academy of Science, St. Louis, Nov. 5.—Dr. Engelmann presented an additional paper on the curious mode of fertilization of the *Agave shawii*. Dr. Engelmann expatiated upon the process of development of the flower. It opens in the evening, and anthers shed

pollen that night, while the stigma is not ready for four or five days to receive the pollen. The rest of the flower withers while the stigma is secreting its liquid.

President Riley read a communication on the life-history of the blister-beetles. After showing that, notwithstanding the importance to commerce and to the pharmacopœa, of the well-known Spanish fly (*Cantharis vesicatoria*), its early life-habits have yet remained a mystery. The same holds true of our American blister-beetles, many of which have the same valuable vesicatory power. The fact that their transformations have hitherto eluded investigation is all the more remarkable that some of the species abound during certain years and are quite injurious to potatoes, tomatoes, beans and other cultivated plants. Prof. Riley has discovered that they prey in the larva state on locust eggs, and he has reared several species from the eggs of that western scourge, the Rocky mountain locust. These blister-beetles are remarkable for passing through many curious changes, which are known as hypermetamorphoses. After illustrating these, Professor Riley gave the following summary:

From the foregoing history of our commoner blister-beetles, it is clear that while they pass through the curious hypermetamorphoses so characteristic of the family, and have many other features in common, yet Epicauta and Macrobasis differ in many important respects from Meloe and Sitaris, the only genera hitherto fully known biologically. To resume what is known of the larval habits of the family, we have:

First, the small, smooth, unarmed, tapering triungulin of the prolific Sitaris, with the thoracic joints subequal, with strong, articulating tarsal claws on the stout-thighed but spineless legs, and, in addition, a caudal spinning apparatus. The mandibles scarcely extend beyond the labrum; the creature seeks the light, and is admirably adapted to adhering to bees but not to burrowing in the ground. The second larva is mellivorous, and the transformations from the coarctate larval stage all take place within the unrent larval skin. We have:

Second, the more spinous and larger triungulin of the still more prolific Meloe, with long caudal setæ, but otherwise closely resembling that of Sitaris in the femoral, tarsal and trophial characters, in the subequal thoracic joints, in the unarmed tibiæ, and in the instinctive love of light and fondness for fastening to bees. The second larva is also mellivorous, but the later transformations take place in the rent and partly shed skins of the second and coarctate larva. We have:

Third, the larger and much more spinous triungulins of the less prolific Epicauta, Macrobasis and Henous, with unequal thoracic joints, powerful mandibles and maxillæ, shortened labrum, slender femora, well-armed tibiæ, slender, spine-like, less perfect tarsal claws—combined with an instinctive love of darkness and tendency to burrow and hide in the ground. The second

larva takes the same food as the first, its skin is almost entirely cast from the coarctate larva, while the subsequent changes are independent and entirely free of the shell of this last.

THE IOWA ACADEMY OF SCIENCE, Sep. 26.—Among the papers read were Observations on the structure of the leaves of *Silphium laciniatum*, by President Bessey. The paper embodied the result of microscopic observations on sections of the leaves of the compass plant. As all know, the blade of the leaves of this plant is always in, or nearly in, the plane of the meridian, and the purpose of the investigation was to determine whether this polarity is correlated with any peculiarity of structure. In ordinary leaves the cells making up the green pulp are differently arranged on the two sides of the blade, being packed closely together beneath the upper surface, forming what is called *palisade* tissue. If leaves be turned so as to expose the under surface to the sun, they either twist the leaf stalk and bring the palisade tissue to the light or die. Every leaf makes an effort to keep the proper upper surface, only, exposed The investigation shows that the two surfaces of compass plant leaves are exactly alike as to structure, both in the matter of palisade tissue and arrangement of the veins. Both sides therefore are equally affected by light, and the equal struggle of the two sides to turn toward the sun gives the blade a position about parallel to the meridian.

A second paper by President Bessey was on dimorphism in Lithospermum. This paper was illustrated by diagrams, and pointed out that while there is complete dimorphism in *Lithospermum canescens*, there is only an appearance of dimorphism in *Lithospermum longiflorum*, due entirely to the varying length of the corolla tube. In early summer, the last named plant bears showy flowers, the corollas of which vary in length from one to two inches. The stamens are always about the same distance from the mouth of the corolla, while the stigma borne on a style that is nearly constant in length, is sometimes above and sometimes below them. In place of dimorphism there is simply extreme and inconstant variation.

Later in the season this plant produces only minute flowers that are not more than a tenth of an inch in length. These later flowers are always self-fertilized.

Professor Todd read a paper on the distribution of forests in South-western Iowa, with considerations regarding the origin of prairies. The writer presented facts showing that the position of prairie and forest is not altogether determined by fires, the fineness of the soil, nor even the distribution of rain, but rather by the constancy of moisture in the air and soil. For example in South-western Iowa , over areas that are essentially identical as regards soil and precipitation, the north slopes are constantly timbered, while the southward-facing slopes are bare.

BOSTON SOCIETY OF NATURAL HISTORY, Nov. 21.—Mr. S. W.

Garman read a paper on some features of erosion in the temperate zones. Dec. 5.—Mr. S. H. Scudder made a communication on certain interesting articulates from the Carboniferous rocks of Illinois, and Professor A. Hyatt remarked on the evolution of the races of *Planorbis multiformis*.

New York Academy of Sciences, Nov. 19.—Professor J. S. St. John read a paper on the application of dry plate photography in preparing, without a camera, glass transparencies of sections of fossils for projection (with lantern illustrations). Professor T. Egleston spoke of some remarkable forms of amethysts from Brazil; and Mr. A. A. Julien remarked on the chemical and microscopical characters of certain American rocks.

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SCIENTIFIC SERIALS.[1]

Quarterly Journal of Microscopical Science.—October. Loxosoma, by Carl Vogt. Abstracted and annotated by the Rev. J. Hincks. On the minute structural Relations of the Red Blood Corpuscles, by A. Boettcher. Notes on the Embryology and Classification of the Animal Kingdom: comprising a Revision of Speculations relative to the Origin and Significance of the Germ-layers, by E. R. Lankester.

The Geological Magazine.—November. American Surface Geology, and its relations to British: with some Remarks on Glacial Conditions in Britain and "The Great Ice Age" of Mr. James Geikie (Part i.), by S. V. Wood. Across Europe and Asia, Part vi. Tornsk to Irkutsk, by J. Milne.

Annals and Magazine of Natural History. — November. On a Carboniferous Hyalonema and other Sponges from Ayrshire, by Prof. and Mr. J. Young.

Annales des Sciences Naturelles.—October 15. Recherches pour servir à l'Histoire de la Respiration chez les Poissons, par M. Jobert. Recherches pour servir a l'Histoire du Bâtonnet optique chez les Crustacés et les Vers, par J. Chatin.

The Geographical Magazine.—November. Quetta and the Afghans, by H. G. Raverty. The Island of Perim.

Canadian Entomologist.—November. Pieris vernalis a variety of Pieris protodice, by T. E. Bean. An account of some farther experiments upon the effect of cold in changing the Form of certain Butterflies, by W. H. Edwards.

[1] The articles enumerated under this head are usually selected.

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